TRANSACTIONS

OF THE

AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

VOLUME XIX

TRANSACTIONS

OF THE

AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

Thirty-Eighth Annual Meeting held at
The Homestead, Hot Springs, Virginia

May 10–11–12, 1926

Vol. XIX

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The Williams & Wilkins Company
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THE AMERICAN ASSOCIATION OF GENITO-URINARY SURGEONS

FIRST DAY, MAY 10, 1926

A CASE OF PYELONEPHRITIS SECONDARY TO ULCERATIVE ENDOCARDITIS

ARTHUR L. CHUTE

Boston, Massachusetts

The following case is reported briefly as showing what has been, in my experience, an unusual cause of pyelonephritis.

I saw in April, 1923, a woman of forty-four the mother of 12 children, 9 of whom were living. In January, 1923, this patient had come down with "grippe" and had been in a hospital for four weeks with "fever, chills, and sweats;" no definite diagnosis had been made but as she had had a greater or lesser amount of bladder discomfort it had been suggested that she might have a renal tuberculosis. The probability of this seemed slightly heightened by the fact that when she came under my care she had a good deal of burning on urination and at times incontinence as well. Beside her urinary symptoms and her attacks of chills, fever, and sweating, she complained of dizziness at times.

This patient entered the hospital with a temperature of 102, pulse 110, scanty urine, and so forth. The temperature went to 104 and the pulse to 130 that evening; she had chills during the night. There was more or less tenderness of her kidneys; her urine showed a large trace of albumin and contained a moderate amount of pus, some granular casts as well as an infection with what appeared to be bacilli of the colon group; no acid fast bacilli could, however, be found.

Her heart was enlarged to the left and downward. There was a systolic murmur at the apex transmitted into the axilla; at times her pulse was very irregular and often I could get no pulse in her right wrist. Her blood pressure was 110/60; her hemoglobin 45 per cent; her white cells 3000; the reds, 2,016,000. I have been unable to find any record

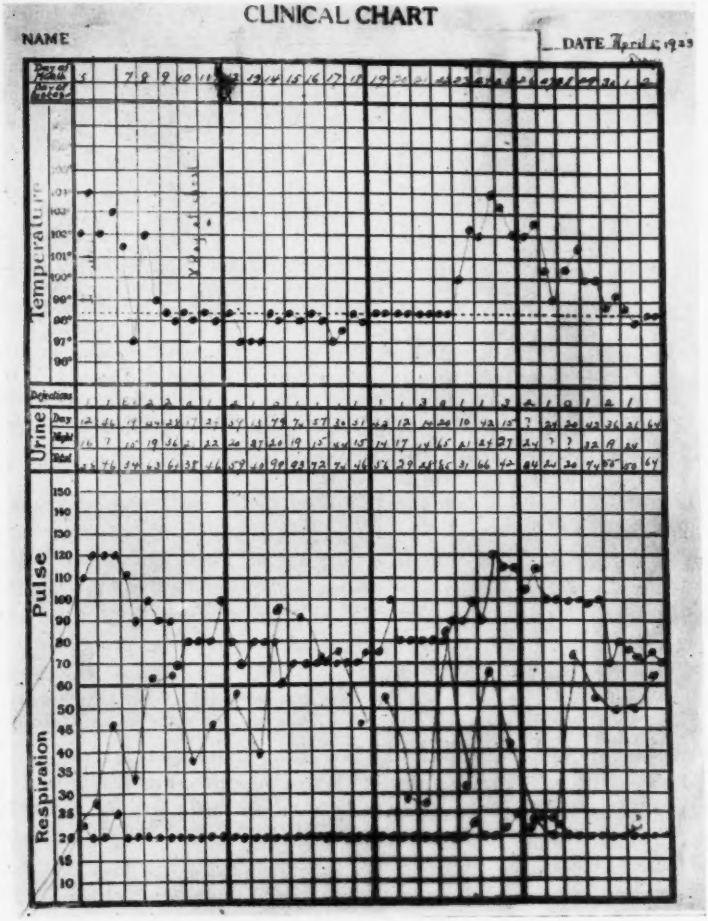


CHART 1

of any differential blood count; two blood cultures taken during her illness were reported negative.

This patient entered the hospital at the height of one of her attacks which had the appearance of a pyelonephritis; this attack quieted down

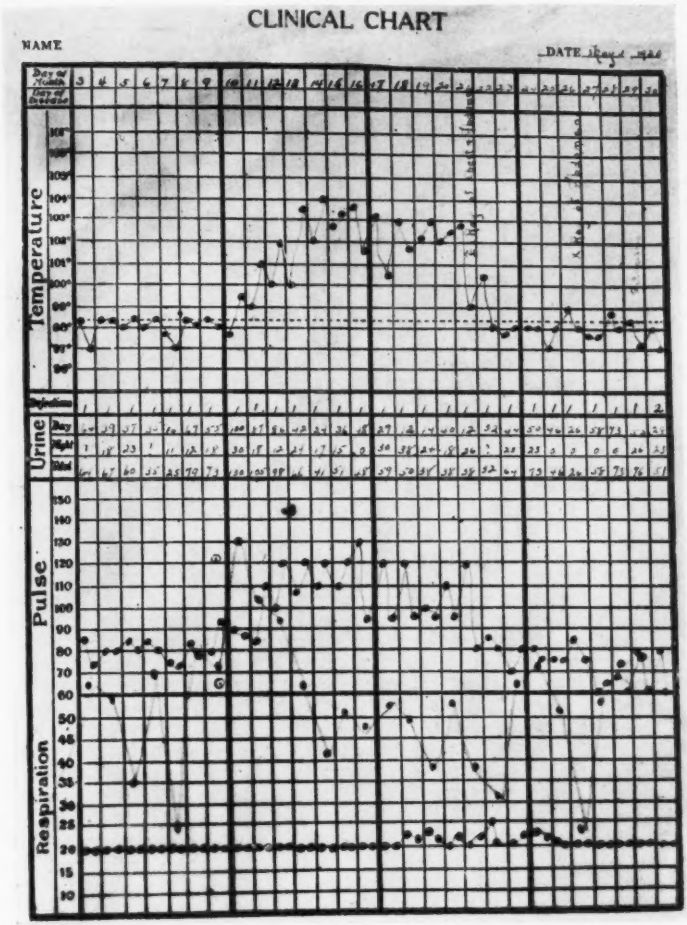


CHART 2

in a matter of a few days. During the twelve weeks this patient was in the hospital she had four attacks that were similar with the exception that there was less tenderness of her kidneys, and less pus until at the time of her discharge from the hospital her urine showed but a few leuco-

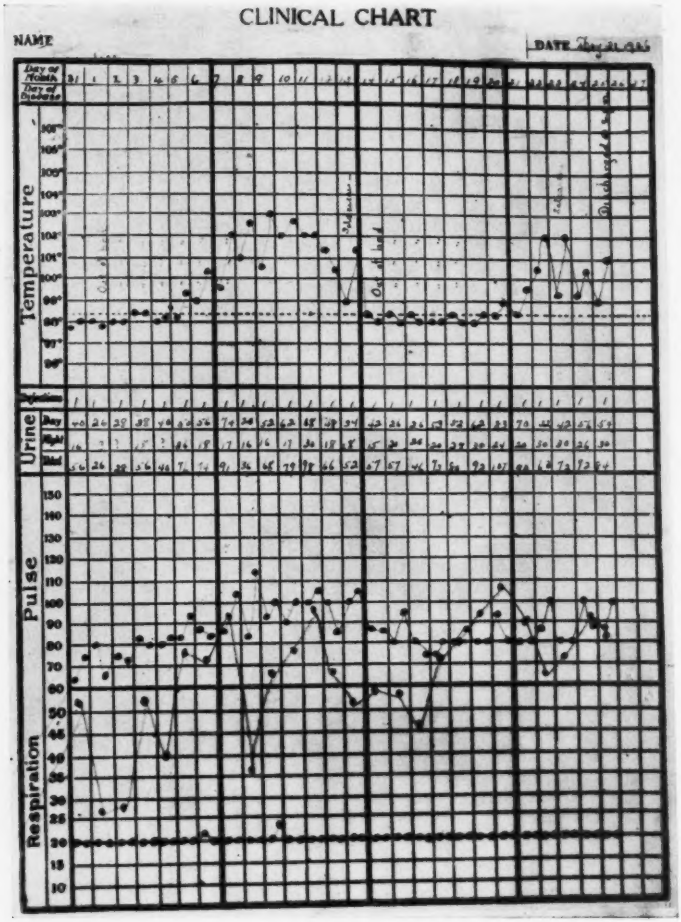


CHART 3

cytes; with some of her attacks there was a suggestion of jaundice. This patient's chills, sweating and prostration seemed to be entirely out of proportion to the apparent intensity of the renal process; this and her cardiac condition seemed to warrant a provisional diagnosis of endo-

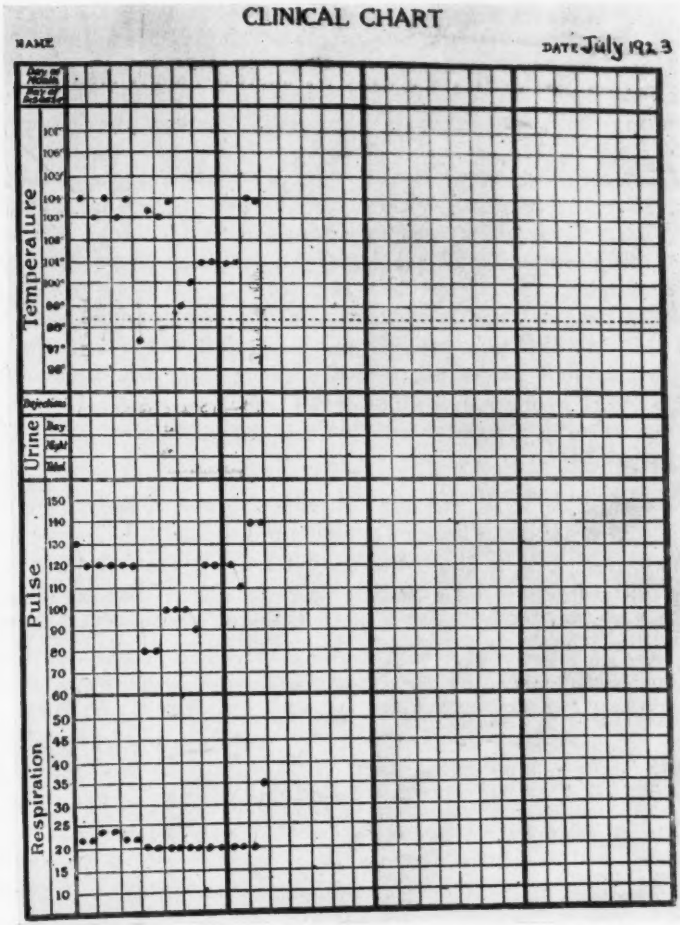


CHART 4

carditis with secondary pyelonephritis or infectious nephritis, if one prefers that term. This diagnosis was not concurred in by the internists. The patient who continued on the medical service, was given hexamethylenamine and general symptomatic treatment as well as 3 doses of

salvarsan of 0.6 mgm. during the last month of her stay in the hospital. After her first month in the hospital the patient had less in the way of urinary findings and symptoms, though her general condition remained much the same. At times she was without any fever and was up and about in a chair. She left the hospital late in June somewhat improved. After a month at home, during which her condition had been much the same, she returned to the hospital. At this time she was jaundiced, had a large liver, dullness in the lower part of her chests, but no urinary findings; her temperature was high; her pulse rapid and poor. She was much duller mentally. This patient died a week after her reëntrance to the hospital.

Autopsy showed fluid in both pleural cavities and an enlarged, congested liver. The heart was pale and flabby but was of normal size. The mitral valves showed multiple vegetations; one of considerable size. The kidneys were large and pale with smooth surfaces. The renal process had evidently cleared up markedly in the last three months of the patient's life.

Endocarditis, so far as I am aware, is an unusual though by no means unrecognized cause of pyelonephritis. In this instance it was interesting to note that in the later disseminations of infection the kidneys were apparently not involved, that the renal process evidently went on to a good degree of recovery in spite of the fact that the source of the infection in the heart persisted. This represents simply a hematogenous renal infection from what I believe is a relatively rare focus.

PYELONEPHRITIS

ITS INCIDENCE, ENGENDERING ELEMENTS AND IMPELLING INFLUENCES

JOHN ROBERTS CAULK

St. Louis, Missouri

Scientific study of the urinary organs has been responsible for the prompt recognition of renal disease, and through it the early care and proper protection of these organs from their hazardous influences. By far the most frequent malady which the urologist encounters is renal infection. All of us have definite impressions as to the frequency of inflammatory conditions in the kidney and yet I imagine few of us realize how almost ubiquitous they are. Owing to the frequency of such infections, the crippling influence which they exert upon renal substance and upon the human economy generally, and from the fact that they contribute the highest mortality to renal surgery, we should, as urologists, make a concerted effort to become more and more familiar with the many phases of this chapter of renal disease, but above all, continue our teaching program to the medical profession in order that individuals so affected may be given the benefit of early study and properly directed therapy. Hence the timeliness of this symposium.

In a recent analysis of 510 operations, which I have performed upon the kidney and recently reported, 7 cases, or 70 per cent of the mortality occurred following operations done for the relief of renal infections, 5 of these were simple drainage affairs for palliation; the patients would have succumbed anyhow.

My small contribution to this symposium will concern the incidence of such diseases and the factors which seem to initiate and perpetuate them. In analyzing the records of the Barnes Hospital, St. Louis Children's Hospital, the Washington University Dispensary and my private office, I have found 2100

cases of renal infections. Of these, 1191 occurred in adults, 909 in infants and children. The comparative frequency of renal infections to other conditions is illustrated by the following: In the Barnes Hospital, a general one, there has occurred 1 kidney infection in every 76 patients admitted to the hospital. In the St. Louis Children's the proportion is higher being 1 in every 40. In my office practice, I was quite surprised to see the ratio 1 to 10. I believe that few of us realize that renal infections occur so frequently in our practice.

There is a decided preponderance of such infections in the female kidney. The relative frequency in male and female seems dependent somewhat upon the period of life. In children, females predominate 3 to 1. In our series there were 684 females and 225 males. In adults the proportion is almost 2 to 1 in favor of the females there being 755 females and 436 males. One hundred and three of these were renal infections complicating pregnancy. If this contributing element be eliminated we will note that the tendency toward infection is not so strikingly different; about 33 per cent in favor of the female. In the latter period of life from fifty to eighty, when renal infections resulting from lower tract obstructions are so frequent in the male, the proportion in male and female about tallies, being 163 to 201. This seems surprising, as I had the impression that infections in the male would be overshadowing at this time of life.

The susceptibility of individuals to infections of the kidney at different ages seems to vary and an analysis by decades indicates that there are certain potential features which influence it.

In infancy and early childhood, renal infections are astondingly prevalent and extremely serious—almost twice as frequent as in the adult. There have occurred 808 cases in the first decade of life. In the Children's Hospital there have been 483 cases; all but 25 of these were under ten years of age; 172 occurred within the first year of life; of these 69 died, a 40 per cent mortality, death being induced in many instances by other constitutional conditions, the kidney being secondary, but very

often the renal condition was the responsible cause of death. Hence, the importance of renal infection as a cause of high infant mortality; Bugbee announced this in a recent article on an analysis of urinary disease in children.

AGE	NUMBER OF CASES
years	
10–20	219
20–30	342
40–50	147
50–80	364*

* 312 of these occurring between fifty and seventy.

One is impressed with the frequency of these infections at the two extremes of life. There is a lull between ten to fifteen and from forty to fifty years. If a child is fortunate to pass the first decade, there may be expected comparative freedom from such diseases until the latter "teens"—when personal punishments, venereal infections, and frequent pregnancies manifest their effect. The period from forty to fifty seems to be the calm before the storm. I shall not enter into a discussion of the many factors which seem to promote infections of the kidney, nor discuss the modes of entry and of the types of bacteria associated with these infections, you are entirely familiar with this bewilderment. I shall simply attempt in this analysis to show the important effects of certain constitutional conditions which serve as igniting embers for these infections and also to emphasize the paramount importance of urinary statis, and to signal the commoner agents which tend to create the causative obstructions.

After an infection enters the kidney whether through the blood stream or by an ascending route, either by direct extension up the ureter or through the lymphatics, the ultimate pathological process may be the same. Indeed it would be very difficult for the most expert pathologist in a given case to be absolutely positive of the progress of the picture, and in observing the clinical records from the different departments it would be impossible to differentiate between a pyelitis and pyelonephritis, or an infected hydronephrosis, from clinical data given.

The mixed salad nomenclature with which we are accustomed simply represents phases and degrees of the same condition of pyelonephritis and is dependent entirely, as are infections elsewhere, upon the virulence, resistance and drainage. The extent of involvement tallies with the relationship of these three factors. The resulting clinical picture, may fluctuate from a simple bacteruria to a more or less complete destruction with or without retention, namely, a pyonephrosis or any atrophic-pyelonephritis. Whether the primitive process is predominantly pelvic, or the reaction rampantly renal, the result may resemble.

The most important feature, not only in the production but in the perpetuation of renal infection, is *stasis*. It may be the result of a pre-existing pathological process within the urinary tract itself or secondary to some extrinsic influence, particularly pressure resulting from morbid processes in some of the other organs or tissues, or it may be *self engendered* or automatic and secondary to the infection from the kidney itself. This latter type is my impression of the fundamental feature in the foreground of a so-called acute pyelonephritis of the type which usually recovers spontaneously, but in many instances leaves its scar.

It is quite noticeable in this analysis that infections occur most commonly at the two extremes of life and usually the result of obstructions at the two extremes of the urinary tract. At the two extremes of life obstructive lesions of the urinary organs are particularly common. During the early adult period, from twenty to thirty, obstructions to the mid-ureter as a result of pressure from the pregnant uterus add greatly to the promotion of renal and ureteral stasis. We have had in this series 103 cases of pyelitis in pregnancy. In a large series of pregnant women which I have examined there is almost invariably renal retention, particularly on the right side.

Obstructions of the lower urinary tract with associated infections above are exceedingly frequent. In infants and children congenital stenoses, whether from scleroses, valves, or neurological defects, either at the bladder neck, the intravesical ureter

or uretero-pelvic juncture, are responsible for terrific destruction of the urinary organs, contributing very highly to infant mortality, as was illustrated in the analysis of our cases reported above. And at this period of life the general systemic infections and serious local reactions in children are so frequent. For instance, in analyzing the infections in children we found that in the Children's Hospital 456 of the 483 had one or more such involvements. Otitis-media heads the list of predisposing diseases, there being 78 cases. There were:

	Number of cases
Complicating pneumonia	51
Associated with other respiratory conditions	36
Intestinal	36
Associated with malnutrition	54
Secondary to tonsilitis	37
Sinusitis	6
Complicating scarlet fever and measles	5
Influenza	5
Following burns	2
Furrunculosis	4
Single case as the result of vaginitis	1

There have been 37 cases of vaginitis in the Children's Hospital and only one complicated by kidney infection. A survey of this would seem to support the theory of blood-borne infections. In the adult, the frequency of feeders, is definite but far less striking. Teeth, tonsils, influenza, furunculosis, constipation, lower tract infections, pelvic inflammatory conditions and nasal sinuses prevail.

I have observed but little tendency toward specificity or selectivity. The organism of renal infection and the one which produced the predisposing lesion were often dissimilar, the resulting renal infection, being prompted by lowered resistance and invaded by organisms common to this location.

Our records seem to show that we may expect obstruction to urinary outflow with its resultant stasis in at least 80 per cent of all infections, and that this stasis is the most important feature toward impelling the infection and the one which demands proper therapeutic handling. I need not take your time to

enumerate the intrinsic and extra urinary conditions which have contributed to obstruction, as they are thoroughly familiar to you. Malformations, pregnancy—prostate—faulty position, calculus and strictures predominate. I must say, however, that my experience with true organic stricture of the ureter without external pressure or pull, and away from the normal physiological constrictions where congenital remnants are so frequent, has been a rarity as a contributing factor. The one particular phase of this complicated subject which I wish to emphasize is what I have termed the self-engendered obstruction, a kidney which is infected acutely, particularly by the bacillary group, passes out its products with little constitutional distrubance until the reaction of the pelvis becomes so pronounced as to occlude its narrowest point, the uretero-pelvic juncture, and thereby in the vicious circle automatically blocks itself through its own inflammatory products without there being a pre-existing obstruction which has either been determined previously or has later been proved to be the case. This is the type of so-called acute pyelitis which recovers in the majority of instances but which I feel leaves many an undetected scar until later years and is often responsible for many of the malicious processes which invade a kidney thereafter.

I feel very firmly that this type of renal retention should not be allowed to remain unemptied, unless there be a very definite contra-indication. Edema and swelling at the uretero-pelvic juncture should be immediately opened by the ureter catheter and the products of septic retention evacuated and drainage instituted rather than to allow these products to remain for a week, ten days to two weeks, exerting their back pressure effects and harmful influences upon the organ. I am well aware of the fact that many of you do not advocate this policy, but, after following so many cases of this type and seeing them promptly recover and remain entirely well, in my hands at least, it is the preferable method of treatment. It is almost invariably easy and simple to give relief, whereas if the patient is allowed to go for some time until the reaction begins to subside, the fever abates, and then a catheter is inserted, a secondary reaction is much more

likely to occur. This is the time that I feel that we have to be so much more careful than during the period of real acuteness.

Relative to stasis resulting from a pre-existing obstruction, ideas have been somewhat at variance. If one should accept the old work of Beidl and Kraus, Lamierre and Abrami, Mayer, Heyn, and others, that a healthy kidney excretes bacteria, it would be perfectly easy to explain these infections as "filth in a pool," or the contamination of a stagnant pond, but the works of Pernice, Scagliose, Sherrington, and more recently Dyke, and particularly the work of Helmholz, have shown very definitely that bacteria are not excreted through a kidney unless the integrity of its secreting surface has been broken. Therefore, it must be a question of pressure and the effect exerted upon the circulatory bed. Whatever be the cause, the effect when once produced should be remedied as promptly as possible to protect against back pressure, whether this be through the tubular system, lymphatic, or the venous channels, as Hinman has recently described, the secretory surface should be protected from further invasion.

THE FUNCTION OF THE RENAL PELVIS AND URETER IN PYELONEPHRITIS

WM. C. QUINBY

From the Urological Clinic of the Peter Bent Brigham Hospital, Boston, Massachusetts

A physiological fact of fundamental importance as regards normal renal function is that the product of renal activity, the urine, be removed from the kidney readily. Under usual conditions the pressure values found in the renal pelvis are but a few millimeters of mercury above zero. Increase of this pressure immediately slows the production of urine till at a point some 50 or 60 mm. of mercury below the systolic blood pressure renal function ceases. The importance of an unimpeded outlet to the bladder is, therefore, very great.

Impediments to the normal function of the pelvis and ureter are commonly of two sorts: those which mechanically encroach on the lumen of these tubes, such, for instance, as a calculus; and those which interfere with peristalsis by alteration of the structure of the passages by the products of inflammation. Normal peristalsis is not possible in the wall of an inflamed and infected tube.

In our treatment of every case of pyelonephritis it is necessary to consider such factors as these and do all possible toward their removal, or at least, toward minimizing their bad effects.

The diagnosis of pyelonephritis once established, we must not only consider the kidney and its apparent degree of crippling but also endeavor to estimate the probable amount of crippling of the excretory channels.

Of first importance as an aid to this end is the pyelogram and ureterogram. Abnormalities such as faults of rotation or position of the kidney; dilatation of the pelvis or of the ureter; and tortuosities or narrowings of the ureter are thus made evident.

Such observations are still further elaborated if stereoscopic films are made.

To these procedures I have been adding from time to time direct observation of the emptying time of the renal pelvis and ureter either by pyeloscopy or by repeated films. The patient being cystoscoped on a table equipped with a fluoroscope, the operator observes both the filling and emptying of the pelvis and ureter while fluid opaque to x-ray is injected into the catheter by an assistant. Or, if a fluoroscope is not used, repeated films may be exposed at about two minute intervals after injection; longer intervals being allowed to elapse in those cases which have previously shown marked obstruction. In either method the catheter is withdrawn and the time noted at which the pelvis and ureter become empty after this. From such observations it has become evident that under the conditions of a good diuresis the normal emptying time of the pelvis is about one or one and a half minutes. Sufficient data are not at hand to give you very exact figures for this because these must vary considerably according to circumstances, as for instance in those cases showing a polyuria on the diseased side. I feel that a delay in emptying longer than four minutes, however, means definite pathology.

Such estimation of the emptying time is of course of no special help in those cases where there is some definite mechanical obstruction, such as stone or other like impediment, but as a rough measure of the extent to which the functional peristaltic value of the pelvis and ureter has been lowered by infection I feel that a knowledge of the emptying time is of distinct aid.

The following cases are illustrative of some of the measures used to combat pyelonephritis.

Case 1. Cure by the use of the inlying ureteral catheter.

A woman of twenty-six years had acute pyelonephritis on the left side and an infantile kidney on the right. She had had intermittent fever and chills and on cystoscopy a cast of pus was seen coming from the left ureter. The emptying time was over nine minutes. The pyelogram showed a moderate dilatation of the pelvis and ureter. She was treated by drainage through an inlying ureteral catheter. The first time the catheter was left in six days, with a reduction of the fever and much

improvement. On its withdrawal the chills recurred necessitating a replacement of the catheter. This occurred on two subsequent occasions. After five weeks of intermittent drainage there was marked improvement, and at the end of three months the patient was well and showed a sterile urine. She has been well and without recurrence for the past year.

Case 2. Stone in the ureter necessitating resection.

A married woman of thirty-six years was found to have at her first examination a hydronephrosis due to a calculus. Not having any acute symptoms at the time, she declined surgical intervention. A year later, during which time she had had three attacks of colic, one of them severe, the stone was found to be in the mid-ureter just below the brim of the true pelvis. At operation there was a very considerable amount of peri-ureteral edema and adhesion of the ureter to its surrounding structures. Over a distance of about 5 cm. the ureteral wall was thin and very friable. The ureter was resected and united by end to end anastomosis over an inlying catheter. Although there was a pyelonephritis of moderate severity at the time of operation, examination a year later showed the patient to be entirely well.

Case 3. Obstruction of the ureter by a calcified lymph node.

A married woman of forty-four years had had a nephrectomy fifteen months before for infectious nephritis with multiple abscesses. Recently she complained of attacks of pain in the remaining kidney and the urine constantly contained pus. A pyelogram showed a moderate dilatation both of the ureter and of the renal pelvis. The shadow of the calcified lymph node was seen opposite the lower lumbar spine close to the ureter. At operation the calcified lymph node was excised and the kidney suspended by a nephropexy in order to aid in obliterating some of the tortuosity of the ureter. The patient was examined six months later, at which time there was found no delay in the emptying time of this kidney, and the urine contained only a rare pus cell. She was feeling well and had had no further attacks of pain.

Case 4. Chronic peri-ureteritis treated by ureterolysis.

A man, thirty-three years of age, had had recurrent attacks of pain in the region of the right kidney over a period of ten years. On a few occasions the pain had been bilateral. He had visited clinics intermittently for five years and many procedures had been adopted, among

them lavage of the kidney pelvis with silver nitrate. The urine from the right kidney showed considerable pus, and a pyelogram showed a blunting of the calices with slight dilatation. The emptying time of the pelvis was ten minutes. There was a narrowed area in the ureter over an extent of about 5 cm. just below the pelvis. This persisted in all the films that were made. Operation showed considerable sclerosis of the fatty tissue about the ureter most dense near the kidney but extending downward as far as the brim of the pelvis. The ureter itself was of normal size, or only slightly enlarged. It did not show any tortuosity. At operation a complete ureterolysis was performed extending downward as far as the brim of the true pelvis.

Subsequent history: The patient is still under treatment for pyelonephritis by hexamethylenamin and hexylresorcinol. He has had no further pain, however, and the present emptying time of the renal pelvis has been reduced to four minutes.

SURGICAL TREATMENT OF CHRONIC PYELONEPHRITIS

WILLIAM F. BRAASCH

Section on Urology, Mayo Clinic, Rochester, Minnesota

Although chronic pyelonephritis is not usually regarded as being amenable to surgical treatment, it may be attended by the following surgical complications: (1) a marked degree of diffuse pyelonephritis in one kidney, with but little or no involvement of the other kidney; (2) stricture of the ureter; (3) hydronephrosis; (4) secondary formation of renal calculus; (5) persistent hematuria, and (6) atrophic pyelonephritis. During the period between January, 1910, and January, 1926, 2040 patients with chronic pyelonephritis were observed at the Mayo Clinic, of whom 68 were operated on for so-called surgical complications.

UNILATERAL EXACERBATION OF PYELONEPHRITIS

With chronic bilateral pyelonephritis the infection may be much more advanced in one kidney and accompanied by reduction of function on that side. The patient may complain of repeated attacks of acute sepsis with, or without, pain referred to one kidney. The urogram will usually show a marked degree of deformity in the pelvis and ureter. In spite of pelvic lavage and ureteral dilatation advanced infection may persist, and nephrectomy may be indicated. The patient's general condition and vesical symptoms are often greatly improved as a result. A cystoscopic examination made later will usually disclose reduction in the degree, and occasionally absence, of the infection in the bladder and remaining kidney. The pathologic changes in the removed kidney are of particular interest. The kidney may be normal in size and show but minor infectious changes exte-

riorly. On section there are usually numerous cicatricial areas involving most of the renal cortex, and also evidence of subacute pyelonephritis with multiple small abscesses surrounding the calices. In some cases a large amount of fat will form in and around the renal pelvis and perirenal tissues.

STRICTURE OF THE URETER

Renal pain with chronic pyelonephritis is usually not severe, and may be caused either by a moderate degree of ureteral obstruction or by the inflammatory process in the kidney. Accompanying the pain there may be recurrent attacks of acute infection in one kidney with chills and fever. Although the symptoms can sometimes be relieved by pelvic lavage and ureteral dilatation, this treatment will usually not be followed by permanent relief. The urogram will usually show only a moderate degree of dilatation of the pelvis, if any. The areas of apparent constriction frequently observed in the ureter are alternating areas of dilatation and narrowing of the ureteral lumen rather than of actual stricture such as are observed with renal tuberculosis, lithiasis, or trauma. The variable degree of ureterectasis may be explained in part by inflammatory rather than obstructive changes in the ureteral wall. This probably accounts for the unsatisfactory results attained in these cases by dilating the ureter. In exceptional cases the entire ureter may become so thickened throughout that the lumen is occluded, a condition which has been described as "ureteritis obliterans." When palliative methods of treatment do not give relief, nephrectomy may be indicated. The improvement in the condition of the bladder and of the other kidney following nephrectomy is often quite remarkable. The removed kidney will show evidence of widespread acute and subacute infection surrounding the dilated calices, together with extensive inflammatory destruction of the parenchyma. Although unilateral complication of these types necessitating nephrectomy will not occur frequently, it was observed in this series in 18 cases.

HYDRONEPHROSIS

Hydronephrosis of such degree as to necessitate surgical treatment occurred secondarily to chronic pyelonephritis in but three cases. When we consider the large number of cases of chronic bilateral pyelonephritis in which there is evidence of ureterectasis, it is striking how seldom the degree of actual stricture is sufficient to cause hydronephrosis.

RENAL STONE

The number of cases of primary chronic bilateral pyelonephritis with coincident renal calculus is surprisingly small. Among approximately 2000 cases of chronic bilateral pyelonephritis observed at the Mayo Clinic evidence of renal lithiasis was present in 30, in but 12 of which operation was performed. It is evident that the etiologic factors of stone formation are different from those of pyelonephritis.

Renal stone occurring with bilateral pyelonephritis may be either primary or secondary; in some cases it is impossible to make a clinical distinction between them. In 3 of the 12 operative cases the stone was comparatively large, situated in the pelvis, and of the type usually seen with primary renal stones. In the other cases the stones were small, 1 cm. in diameter or less, and they were multiple in 6 cases. The stones were usually situated in the parenchyma adjacent to the minor calices, and in several cases they might be described as cortical. The question arose in some of these cases whether it was advisable to operate and cause the destruction of renal tissue necessary to the removal of the stones or to leave them as long as they caused no acute symptoms. When numerous small stones are scattered throughout both kidneys, as happened in several cases, surgical treatment is usually inadvisable. In cases of chronic pyelonephritis the roentgenogram will often show minute calcified areas scattered in the kidney; these are too small to be removed. In 1 case in which multiple phosphatic stones were removed from the kidney, the bilateral pyelonephritis was apparently secondary to exstrophy

of the bladder. On culture the organism was found to be Proteus ammoniae recently described by Hager and Magath. It would seem probable that a secondary organism of this type will be found to occur more frequently with stones secondary to pyelonephritis. Doubtless among approximately 1200 patients operated on at the Clinic for apparent primary renal stone, there were other cases of primary unilateral pyelonephritis, but they cannot always be clinically differentiated and so were not included in this series.

Patients are occasionally observed with pyelonephritis persisting for a variable length of time following the removal of what was apparently renal stone. This occurs usually when multiple stones are removed from the minor calices or from adjacent renal parenchyma. Such infection is occasionally observed persisting for several years, even though a thorough course of pelvic lavage and ureteral dilatation was given following nephrolithotomy, and nephrectomy may then be necessary. It would seem that factors are involved in determining the persistence of such infection which cannot be eradicated by means of cystoscopic treatment.

HEMATURIA

Hematuria with pyelonephritis is usually self-limiting or can be controlled by lavage with solutions of silver nitrate. In exceptional cases, however, the hematuria may become so extreme and so persistent that in spite of the usual methods of treatment nephrectomy may be necessary. The cicatricial changes in both ureter and pelvis are then so advanced that the function of the affected kidney is usually either markedly reduced or lost. In one case of unilateral hematuria, pyelonephritis of moderate degree was present in both kidneys. The methods usually employed failed to control the hematuria, so that removal of the kidney was necessary. In another case of bilateral pyelonephritis, unilateral renal hematuria was so persistent that nephrectomy was performed; on section of the kidney a hypernephroma, 5 cm. in diameter, was found in the upper pole.

ATROPHIC PYELONEPHRITIS

Although atrophic pyelonephritis is a distinct type of chronic pyelonephritis and is usually unilateral, it is occasionally observed as a complication of bilateral pyelonephritis. The etiologic factors of atrophic pyelonephritis are evidently unlike those involved in the ordinary chronic pyelonephritis and are probably the end-result of septic infarcts. That obstruction is not a factor is evident since pyelectasis or ureterectasis is frequently absent. When pyelectasis is present, it is never advanced enough to cause cortical atrophy and is evidently of secondary importance. The renal pathologic changes are different from those observed with terminal bilateral pyelonephritis. The following is a description of typical kidneys removed for atrophic pyelonephritis: (1) the kidney varies from 3 to 4 cm. in length to approximately one-third of the normal; (2) the kidney is surrounded by dense adhesions and may be difficult to find; (3) the hilum is usually invaded by large deposits of fat; (4) the renal pelvis is usually markedly thickened and cicatrized, and (5) on section the renal cortex is irregular and shows many pale areas of cicatricial degeneration. Besides the 22 cases that I reported in a previous paper in which operation had been performed at the Mayo Clinic for atrophic pyelonephritis, there have been 9 other cases.

Unilateral chronic pyelonephritis, other than the atrophic form, occurs so seldom that when it is observed one should suspect the possibility of some underlying pathologic cause such as obscure ureteral stone or renal tuberculosis. When, however, these etiologic factors are excluded, the diagnosis of unilateral pyelonephritis must be recognized. It should be remembered that the other kidney must be catheterized repeatedly before the infection can be regarded as unilateral. It is not at all uncommon to find that the urine from the other kidney, negative on microscopic examination on one occasion, contains many pus cells on subsequent examination. The clinical data and pathologic findings are similar to those described with unilateral exacerbation of pyelonephritis. Some of these cases were probably the result of acute bilateral pyelonephritis in which the infection persisted in

one kidney as the result of septic infarcts or some anatomic factor.

PALLIATIVE SURGICAL TREATMENT

We have not found palliative operations, such an nephrorrhaphy, decapsulation, pyelotomy with drainage, or nephrotomy, of any value in any of the cases of chronic pyelonephritis.

SURGICAL COMPLICATION IN OTHER ORGANS

Chronic bilateral pyelonephritis is frequently coincident with surgical conditions in other portions of the body, and usually offers no contraindication to operation. It has been my experience that it probably occurs most frequently with infections of the gallbladder and hyperthyroidism. In the case of the former, both may be manifestations of the same infection. It may well be that an infected gallbladder can act as a focus of infection for persistent pyelonephritis. In cases of hyperthyroidism the coincident renal infection probably depends on lowered resistance. In many of these cases the renal infection may disappear soon after the hyperthyroidism is corrected.

Bilateral pyelonephritis consequent upon prostatic hypertrophy with retention will usually disappear in the course of time when the underlying factors are corrected. When the pyelonephritis is accompanied by cicatricial prostatitis and little or no retention of urine in the bladder, the results from prostatectomy are frequently not satisfactory and the pyelonephritis will frequently persist. Pyelonephritis not present previously but persisting following prostatectomy may be difficult to eradicate. Its persistence is generally attributed to minor postoperative obstruction such as from prostatic tags and cicatricial contraction. It has also been observed as a result of postoperative seminal vesiculitis. However, even though these conditions are adequately treated, pyelonephritis may persist. In most of these cases lavage of the renal pelvis and dilatation of the ureter do not seem to reduce the infection, which may cause considerable dysuria and frequency. Recurrent attacks of fever may accom-

pany this condition, and we have observed several such cases which were benefited by intravenous administration of mercurochrome.

CONCLUSIONS

It is evident that with chronic pyelonephritis complications may arise which necessitate surgical treatment. When such complications are unilateral and do not yield to the usual methods of treatment, nephrectomy may be indicated even though the renal infection is bilateral.

PARARENAL INFLAMMATIONS

LOUIS E. SCHMIDT

Chicago, Illinois

From my personal observation I can definitely state that inflammations in and around the kidney, metastatic in character, are not as unusual as the literature would indicate. Hunt states that infection and inflammatory reaction in the perirenal tissues are common findings at operation and at necropsy, but that true abscess formation in this area is uncommon. I rather agree with Lichtenstern that abscesses involving the structures surrounding the kidney are not uncommon, on the contrary are of such frequency and importance that they must always be considered in the differential diagnoses of acute upper quadrant disease. Kuster in 20,000 cases met with only 4 cases of paranephritis. Other authors could be quoted, but they only mention the number of cases seen over a period of years without giving an idea as to their frequency. In 59 of the 106 cases of perinephritic abscess observed at the Mayo Clinic during the last ten years (June, 1924, Hunt) no primary renal lesion could be demonstrated. Furthermore, Hunt states that cortical abscesses, single or multiple, form an important surgical lesion of the kidney as is indicated by the fact that 179 of the 1835 nephrectomies were undertaken because of cortical abscesses. These I should judge were probably not metastatic in character, but were secondary to some definite condition within the kidney, permitting infection to take place. Braasch states this is a comparatively common type of renal infection and produces but few, if any, urinary symptoms. I would be inclined to refer to the cases of Hunt and Braasch as perirenal abscesses. Subcortical abscesses or the multiple abscesses of the kidney substance still occasionally mentioned as Brewer's Disease, may be grouped under the heading of "car-

buncle" as they are all forms of a suppurative nephritis and most often metastatic in character. Wildbolz refers to inflammation within the fatty capsule as either peri- or epinephritis and when outside of the fatty capsule paranephritis. Inflammations of the fatty capsule should be considered as an entity. As early as 1839 Rayer described the symptomatology and referred to it as perinephritis; under which term he included both the fatty capsule and the fat around the fatty capsule. Israel with his acute diagnostic ability tried to conform to the anatomico pathological findings and introduced his nomenclature of perinephritis, epinephritis and paranephritis, i.e., inflammation of the fibrous capsule, of the fatty capsule and of the fat around the fatty capsule. My impression is that it is extremely difficult to do so clinically. It is almost impossible to set up a definite clinical picture on account of the absence of pathognomonic signs or symptoms in each case. It is also impossible to distinguish, at least in early cases, between epinephritis and paranephritis; however, it is occasionally distinguishable from acute perinephritis and as a rule from some of the forms of acute suppurative nephritis. Because of these diagnostic difficulties, I believe it is perfectly satisfactory to group all three conditions referred to by Israel into one group, practically that of Rayer, and be content with a diagnosis of this kind, although Rayer referred to all of them as perinephritic. However, no objection can be made to any attempt at differentiating the conditions clinically. It is my custom to refer to the inflammatory conditions of the fibrous capsule as perinephritis and to inflammatory processes of the fatty capsule and the surrounding adipose tissue as *paranephritis*. Looking over the literature many authorities, Necker, Kukula, Klose, in recent articles refer to abscesses within the fatty capsule as *perinephritis* and to *paranephritis* when the retroperitoneal fat surrounding the fatty capsule is involved. I need only to reiterate that the nomenclature is still in a chaotic state. Naturally there have been and always will be attempts to make accurate diagnoses. If all suppurative processes within the fibrous capsule are referred to as suppurative nephritis and are diagnosed as such, as a rule a surgical condition is established except in the

presence of a miliary tuberculosis, malignant endocarditis or similar condition. However, within the memory of some of the members it was considered best to treat these conditions medically. I include the subcapsular or cortical abscesses in this group. Of course in this group urinary findings are always present. In the acute stage blood is present, later pus, while albumin is a constant finding. These findings are in contradistinction to the findings in inflammations of the fibrous capsule and inflammations of the fat surrounding the kidney. Naturally in diagnosing these cases, attempts are made to determine the source of the infection, whether from the blood, lymph stream or by direct extension through the ureters or from neighboring organs. An attempt should also be made to determine whether the abscesses are grouped or generally distributed under the fibrous capsule or throughout the kidney substance, or whether a single definite abscess is present. Attempts have also been made to establish the presence or absence of pus. If absent there is naturally a leuco or lymphocytic infiltration with a tendency towards cicatrization. Riedel recognizes primary as well as secondary paranephritis. As I understand the latter, he simply infers that it occurs by extension from the neighboring structures. The former or primary paranephritis is probably haematogenous or lymphogenous in origin from some focal source. In the group referred to as *secondary paranephritis* where the source of trouble is derived from some neighboring organ, whether adjacent or distant, I need only mention the kidney itself, particularly in cases of tuberculosis, stone, or infections of all kinds; the chest, the abdominal organs, the pelvic organs and finally the lower urinary tract, when the tissue around the kidney becomes involved and with its known poor circulatory arrangement, infection may easily spread.

When one considers the prevalence of diseases having a definite bacteriological basis, it is surprising that there is not an even greater frequency. I need only point to the common cold, practically all types of respiratory diseases, skin diseases, particularly the carbuncle, and diseases based on infections in general, finally the bowel diseases, even obstipation having been con-

sidered as a focal source. In some instances the fatty capsule is changed into a hard scar tissue, referred to as the fibrous sclerotic type of paranephritis, perinephritis of Israel. Again undoubtedly the hyperplasia of fat tissue, particularly common in kidney stone, which often involves the tissue around the hilus as well as around the kidney, is another type of paranephritis commonly met with. The fat becomes dense and assumes an almost cicatricial hardness.

The object of this paper is to draw particular attention to the *metastatic types* of *infection* or *inflammation*. As a rule there is abscess formation in the fatty tissue around the kidney whether the infection takes place within or without the so called fatty capsule. However, for a fuller understanding of the subject, I have discussed to some extent the nomenclature and classification of the kidney as well as the surrounding tissue regardless of the source of infection.

With the present knowledge of distribution and anastomosis of the lymphatic system, the extension from neighboring, as well as from distant parts above mentioned, is readily explained. Dittrich and others have shown, at least by their statistics that the male is involved twice as often as the female, most commonly between the ages of 20 and 40 years. Later statistics do not give this ratio, although the older agree with mine. Double sided cases are extremely rare as I can find but few instances in the literature. Right side is apparently more commonly involved, although statistics of Hunt only show 55 on the right, 50 on the left, and 1 bilateral.

All kinds of bacteria have been demonstrated in pararenal inflammations and abscesses and in many instances double infections.

There can be no doubt that traumatism plays a rôle in the localization of infection. Direct body blows over the kidney region, excessive muscular effort at time of work or play may cause torsion and tearing of the fatty tissue and thus play a part in preparing the area for infection.

Considerable experimental work has been done by Rehn-Schnitzler-Albarran and others, yet the situation has not been

thoroughly clarified. Albarran injected colon bacilli into the ear veins of a rabbit, produced traumatism of the kidney region and succeeded in producing abscess in the fat surrounding the kidney.

For practical purposes it is possible to classify the clinical cases of paranephritis into (1) The *acute type*, where there is a rapid and diffuse pus formation involving more or less of the fatty structures surrounding the kidney; (2) the *subacute type*, where the course is slower and the tendency of the infection is to localize and remain confined to definite limits and possibly to resorption; and (3) the *chronic type* where during the course of inflammation there is a greater tendency to cicatrization rather than pus formation.

In the acute type the kidney may be partially or completely surrounded with pus which may be thin or creamy, of variable color, and of varying degree of odor and quantity. The abscess may extend from the diaphragm down into the pelvis or may be more or less localized to the upper or lower pole, or anteriorly or posteriorly to the kidney.

In the subacute type the fat as a rule is firm and dense and the abscess or abscesses are not easily found because of their small size. Again they may communicate with each other, the cavities having granulating surfaces containing often but little secretion or debris of variable color, consistency and odor.

In the chronic type in the true sense of the word, no abscesses are found. All the tissues surrounding the kidney, the fibrous and fatty capsule and the retroperitoneal fat may be all bound together, greatly thickened and often in the course of time attain an astonishing hardness, undoubtedly producing gradual but definite compression of the kidney. Considering that the process also involves the fatty tissue around the hilus, it has been found that the compression of the vessels is so great that I myself have seen in the course of a nephrectomy that no ligatures were needed to stop hemorrhage.

In the diagnosis of paranephritis, particularly in the early stages, there are neither pathognomonic signs or symptoms nor any symptom complex on which to base a positive diagnosis.

Fever and pain are practically always present. It can readily be seen that there can be no type of fever. In most instances there is at least a chilly sensation, more often a distinct and sometimes an extremely severe chill. There may be repeated chills of varying severity, also accordingly varying temperatures. In the acute fulminating type there is a terrific chill with high temperature and prostration accompanied with delirium. On the other hand there may be only a sensation of chilliness even in the acute type and the temperature may be comparatively moderate or in some instances practically normal. The temperature may persist over many weeks in the absence of any marked physical findings. Undoubtedly if the source of infection is from nearby or distant organs, the temperature may be varied in the same manner as the symptomatology, by the course of the underlying disease. Pain may be intense from the beginning and is usually referred to the deep structures, often in either upper quadrant depending on the side involved, but more often posteriorly and more definitely localized to the area of the kidney or lumbar region. Pain is practically constant, as a rule is not changeable nor intermittent; yet it may be variable, possibly due to change of posture, breathing, coughing or active peristalsis of the bowel.

With the fever and pain, the usual picture of sepsis appears after a week or two, loss of appetite, constipation, loss of weight, nausea, vomiting and cold perspiration. I have always looked for edema and redness at the outer border of the sacrolumbalis muscle, chiefly in the lumbar region, and can only recall finding it a few times in acute cases, although the text books insist on their presence. In the advanced or chronic cases they are more frequently present. In those cases where there is a referred pain in the knee, the abscess has undoubtedly entered the pelvis; these findings are to be noted as low as the inguinal region anteriorly. In many of the advanced cases distinct bulging, either anteriorly or posteriorly below the last rib or in Petit's triangle, may be noted. Cases of spontaneous rupture at the latter site are recorded. It is needless to add that in other instances, depending on the localization or progression of the disease, such conditions as peripleural empyema, endophrenic abscess, rupture

into any of the hollow organs, will by their symptomatology and findings draw our attention to the parts involved.

The *urinary findings* are in most instances to my knowledge practically negative although even in the cases where no involvement of the kidney exists, albumin is as a rule present. In every instance, without exception, red blood cells may be found. In true cases of pararenal inflammation, these findings are practically pathognomonic. The presence of pus would indicate involvement of the kidney. These facts I have corroborated by ureteral catheterization, there being distinct differences of the separately collected urines. The cultures have always been negative. I have carried out the phenolphthalein test and found as did Walther that there is only the slightest, if any, difference between the two sides.

The *blood findings* are what would be expected under the circumstances. In the acute types it is not uncommon to find a 25,000 to 40,000 leucocyte count. When the abscess has broken through the confining tissues and is no longer under tension, the white count may drop and remain comparatively low. The blood chemistry in all the metastatic cases of paranephritis with absence of involvement of the kidney, has been well within the normal range.

The *roentgenological signs* are undoubtedly of help if good technic is employed. However they are not sufficiently often taken into consideration as they are not easily recognizable; but if positive they are of definite aid in establishing a positive diagnosis. Lack of clearness in the outline of the kidney in the acute type with pus formation, sharp outline of the contour of the kidney wherever the sclerotic process of pararenal inflammation is present may be seen. Undoubtedly considering the density of the structures in this area, pus formation, if the abscess is of considerable size, ought as such be recognized in a good radiogram. In cases where the origin is from within the pelvis of the kidney, fistulous tracts have been found with the help of the x-rays during the course of making a pyelogram, such a case being reported by Hagner.

If a fistulous tract opens on the skin, various pastes and solu-

tions have been used to demonstrate the extent and course of the fistula. Naturally these findings, are only available after abscesses have opened either into the bowel or through the skin. They give an idea as to the extent of the infection and also as to the other organs involved.

Distortions or irregularities of the diaphragm as well as of the abdominal organs, more or less fixation of the diaphragm on the involved side and many other observations have been made. Although I do not advocate pyelography in this type of case, I have made several in which the diagnosis was in doubt. It was my impression that there was a compression of the pelvis of the kidney. Dr. Jenkinson, the radiologist of St. Luke's Hospital, was rather inclined to the belief that the outlines were normal. This agrees with the findings of Walther in the report of his case. Practically in all instances there is an *absence* of *urinary symptoms*. There is no frequency nor painful urination unless involvement of the urinary tract is present. Reflex urinary symptoms such as are common in true kidney diseases are absent.

Diagnostic mistakes, particularly in the acute metastatic type, are easily made because of the fact that the abscesses may remain small for some time and because of their deep localization. The fact that no renal symptoms manifest themselves and the urinary findings in these early periods may be practically negligible also serve to confuse the diagnosis even when it is suspected. It is not uncommon for local symptoms to be practically absent or of such minor character as to be overlooked. In many instances, on the other hand, the patient may be extremely sick with high fever, gastrointestinal symptoms, headaches and yet the physical findings be entirely negative. Undoubtedly it is in just this type of case that one's diagnostic ability comes into play. Knowledge of the significance of what one considers minor findings in the course of extremely careful palpation, may be sufficient together with other indefinite signs and symptoms to come to positive conclusions and a diagnosis. It is needless to state that with the progression of the inflammatory condition, in other words in the advanced cases, the diagnosis is more readily made, but in many instances even these demand the greatest

consideration when questions arise in the course of the differential diagnosis. I consider diagnostic puncture in acute cases a dangerous procedure. Operative interference is certainly advisable if one considers the possibility of finding pus. I have already referred to subphrenic abscesses, particularly if the abscess is in or about the upper pole: here one may expect nausea and vomiting. Those in front of the kidney may involve the peritoneum, and distention, eructations and hiccoughing are not uncommon. Those abscesses posterior to the kidney more frequently give rise to muscular and spinal symptoms.

As regards the prognosis, it can be definitely stated that it is good. Considering often the extent of the involvement, it is rather remarkable that the immediate results of operative treatment are so extremely satisfactory. It is only in the acute metastatic type, particularly if the abscess is in juxtaposition to the peritoneum, that the progress of the phlegmonous process may be so rapid that the peritoneum has not sufficient time to wall itself off in order to avoid perforation. I have seen in subacute cases perforation of the large, as well as of the small intestines, burrowing of the abscess into the pelvis and spontaneous rupture at Petit's triangle. The spontaneous rupture does not lead to convalescence but often to further complications and further operative treatment.

The treatment of the acute type in the incipient period consists of hydrotherapeutic methods. Either ice bags or somewhat later large hot moist compresses encircling the entire trunk from axillae to the hips, attention to the bowels and general condition of the patient, are indicated. At different times I have seen what may sound strange, too early operative interference by thoroughly competent surgeons unable to locate the abscess. For this reason it has been my practice, and I will say that I have as yet no cause for regret, to wait—naturally not too long—until I am certain of finding the abscess. This period of time is crucial and cannot be stressed too much. Too small incisions are not to be advocated. Typical kidney incisions are recommended as it is desirable to be in complete control of whatever procedures may be necessary. All bridges are torn asunder and in the late cases

the kidney is found at times in an enormous pocket of pus. It may be necessary in these, as well as in those cases not so far advanced, to open subcapsular abscesses of the kidney. This can be done without fear of bad result. In a few instances I have removed the entire fibrous capsule where it seemed indicated on account of presence of subcapsular abscesses with perfect result. The problem comes up when the kidney is thus found freely movable of fixing it into the correct position. This I have done at different times with iodoform strips producing a hammock as first recommended by Senn in the operative treatment of movable kidney.

In the subacute type the involved tissue should be completely removed and this means that thorough exploration is necessary as multiple abscess and their intercommunications must be destroyed or removed.

In the chronic forms of paranephritis, removal of the sclerotic tissue must be carried out. This includes not only the tissue around the kidney but particularly the encircling fibers around the pelvis and the renal vessels for it is upon this point that the success of the operation depends. As stated previously it may only be necessary to remove the fibrous capsule—decapsulation. The fatty capsule or other surrounding tissue may not be involved. In decapsulation the same care in removing all the tissue involved must be taken, that involving the vessels is essential when functional and other results are to be considered.

These three types are arbitrarily set up because of the variable symptomatology of paranephritis which is due to not only the anatomical parts involved but also to extent of involvement and character of infection, that is, the virulency. The basic or focal source of the infection and finally the tendency to pus formation or to sclerization must be also taken into consideration.

As there are diagnostic mistakes so are there also operative mistakes. In order to avoid these, lateral incisions, preferably of the Israel type are to be recommended. This always allows of increasing the size in either direction besides permitting of whatever other operative measures may be necessary. It has been recommended to fix kidneys with through and through sutures.

This is I think a mistake and unnecessary. One of the errors commonly made is in waiting too long before operation, thus allowing too great extension of the abscess with all the concurrent possibilities of complications. Pin hole incisions not allowing of thorough exploration of the cavity nor of proper drainage are to be condemned.

DISCUSSION

Dr. Arthur L. Chute (Boston): Mr. Chairman, may I ask Dr. Quinby if he will make it a little clearer just how he measures the emptying time of the kidney pelvis? Perhaps I was stupid but I did not follow just how he calculated it, and I should like very much to know.

In reference to Dr. Schmidt's paper, I think it is possible to overstress the importance of waiting for pus to form in perirenal abscesses. It has been my experience that where a person, particularly a man, has pain high up in the costoiliac space, accompanied by temperature and tenderness high up in the triangle, that if you will cut down you will almost invariably find a little pus. Oftentimes you will have to search for it carefully and may find but a little near the upper-inner surface of the kidney.

A year ago, just before starting for our meeting I saw a case of this type where I had to make a very careful search before I was able to find a drachm or two of pus that was near the upper pole of the kidney of a young man who had had a temperature for a considerable time. I believe by going in early and searching carefully the region behind and to the inside of the upper pole of the kidney that we will often find the focus of pus relatively early and save the patient a tremendous amount of time, as it often takes a considerable number of weeks before one gets symptoms that point unmistakably to a collection of pus.

Dr. Arthur H. Paine (Rochester, N.Y.): I do not think this discussion and exhibition of a specimen and two slides will be out of place.

A year ago I presented to this Society a paper which was important to me, on the "Operative treatment of undilatable stricture of the urethra," and I have been anxious to apply the same

operative procedure to one of these undilatable constrictions of the ureter, call it inflammatory stricture, or what you like. Just recently I have had opportunity to study a girl, fifteen years old, who had been previously operated upon for an appendix. She had no history of previous infection of any importance, measles and whooping cough being the only diseases.

Five years ago her illness started with extreme nervousness and restlessness. Four years ago she began to have pain in the right lower abdomen, worse on active physical exertion. She had severe attacks of pain lasting a week or more. Pain located over McBurney's point. No radiation and no bladder irritability.

Three years ago she had a severe attack of pain and appendix was removed. No relief from pain and the attacks continued with only slight remissions.

One year ago she began to have gastric disturbance, nausea and vomiting, and became unable to voluntarily flex right thigh. Passive flexion of thigh was accomplished with great pain. The patient persistently held a finger in the center of the appendix scar, indicating the site of pain. One could find her any time of the night or day with a finger pressed over this appendix scar, to relieve pain apparently.

(Slide) This would ordinarily, I think, be called a normal spindle of the ureter. Right in this section for about five centimeters, with a Braasch bougie, could be found "bumps" like railroad ties. As the bougie was withdrawn, either through the cystoscope or by removing the cystoscope and withdrawing the bougie directly through the urethra, a series of very marked obstructions were perceived. The function of the kidney was distinctly altered, and it is quite evident from the pyelogram that there is a dilated pelvis and dilated calices.

I advised nephrectomy but the family insisted on having the scar investigated, and I was rather glad to have an opportunity to investigate the ureter. The abdomen was opened—nothing abnormal found at the site of appendectomy. The posterior peritoneum was infiltrated and markedly discolored in an area 4 cm. wide and 10 cm. long over the pelvic ureter. The posterior peritoneum was incised, the ureter exposed and freed.

It was found to be markedly thickened as this specimen demonstrates. Below the broad ligament it was found perfectly normal to its entrance in the bladder.

I tried to free this inflammatory tissue and cicatrix around the ureter, but entered the lumen of the ureter very quickly.

(Slide) There is an infiltration throughout this whole section of round cells and plasma-cells.

If this is not an inflammatory stricture and is not a definite point of obstruction (even though the ureterograph does not show it definitely), I would like to get the opinion of the men as to what the pathological process is.

Dr. WILLIAM W. TOWNSEND (Burlington, Vt.): I would like to ask Dr. Quinby, in closing, if he will tell us something about this double-barreled drainage catheter. I want to ask him if, when the catheter becomes plugged with thick pus, as in case no. 2 described by him, the injection of fluid up the barrel of the catheter at any time produces colic, which is followed by temperature, etc., as in the case with a single-barreled catheter.

Dr. ALEXANDER RANDALL (Philadelphia): This symposium is a little blurred to me because the first three essayists did not appear to differentiate between their acute and their chronic pyelonephritis cases in their diagnoses and in their handling. Dr. Braasch, I believe, did limit his remarks only to the chronic form.

It has been my fortune to remove two kidneys of Dr. Braasch's atrophic pyelonephritis in the last year, both of them operated upon on account of a persistent unilateral hematuria and both with positive Wassermanns, bringing that out as one possible etiological factor (I do not know whether Dr. Braasch recognized that) and both cases without other bacteriological reasons or findings. Apparently, this was the only thing we could lay the atrophic process to.

Both Dr. Caulk and Dr. Quinby talked about ureteral catheterization, and doing pyelograms in these cases of pyelonephritis. The only cloud I left home under was a patient with an acute

pyelonephritis, secondary to a differential function test, in a lad sixteen years of age. The temperature was 104; leukocyte count 20,000. I would like to ask whether they would feel justified in doing pyelograms in a case like that. I could not bring myself to it, because shortly before this misfortune I attended a five-week-old baby with a congenital valve of the posterior urethra. We were palliating and using the catheter to relieve a partial but not a complete vesical retention. The baby subsequently died, and the pathological picture which we found was so vivid in my mind as to what an acute ascending pyelonephritis was with extensive miliary abscess formation that I raise this question as to whether we do not use too much instrumentation in pyelonephritis, and as to what good (except in actual ureteral blockage) catheter drainage can perform with the infection throughout the kidney mass.

Dr. GEORGE R. LIVERMORE (Memphis): Dr. Braasch reminds me of the man who threw a brick, then said he hoped he would not start any trouble. (Laughter.) In his pictures and in his talk he admits the fact that he had some cases of stricture, and I think that Dr. Paine's demonstration of his beautiful case more than goes to prove that stricture certainly does exist.

In regard to Dr. Caulk's idea of catheter draining in the acute cases, I think he is absolutely correct, and I believe we make a mistake to postpone catheter drainage because during the acute condition we get acute congestion and an inflammatory thickening of the ureteral mucosa, and hence back pressure, which helps to increase and force the infection deeper into the tissues. Therefore, if we use a catheter and stop this back pressure, and get drainage we relieve the very condition that we are trying to relieve. So that I, for one, agree with him most heartily in the use of the catheter in the acute conditions.

Dr. HERMAN L. KRETSCHMER (Chicago): I would like to discuss Dr. Chute's very interesting case. Renal complications of ulcerative endocarditis are not so unusual. They are of two types: one type which was described by Dr. Chute, in which the

renal lesion is a nephritis or a pyelonephritis; the second type in which there is found areas of infarction in the kidneys, exactly as one sees it in the spleen.

I have been fortunate in seeing several cases, one or two of which I would like to mention:

In one case, ulcerative endocarditis produced kidney changes, manifested with the presence of pus and Streptococcus viridans in the urine. Further examination of the patient showed many infected teeth. These were removed. Cultures made from the abscessed teeth showed Streptococcus viridans which no doubt were the starting point for the malignant endocarditis.

A second patient was a man who came in because he had a gross bleeding. He had an enlarged spleen, which on autopsy, showed the presence of many areas of infarction, so often found in malignant endocarditis. The kidneys showed extensive nephritic changes, besides several old healed infarcts.

Dr. Ernest G. Crabtree (Boston): In regard to Dr. Caulk's idea of drainage in the acute stage, I think there is something in favor of it.

I wish to point out one group of cases in which it is of great value, and that is the postpartum pyelitis in pregnancy. During the past seven years, I have been connected with the Boston Lying-In Hospital as urologist. During the past year we have had a clinic for the follow-up work, to see that pregnancy cases were clear of infection before the next pregnancy hit them. Not always do we succeed in accomplishing that purpose. Pregnancies come too fast.

In the postpartum cases in which there has been back pressure in the kidney, becoming infected at the end of the pregnancy, they have residuals, small in amount, and thick urines. Even in the most acute stage, those cases are greatly benefited by the catheter clearing out the pus which those kidneys contain.

That also has influence on the ultimate recovery. Those cases treated early make a much more speedy recovery to a bacteria-free urine. Those allowed to carry along for one, two or even three weeks make slow recoveries.

The inlying catheter has not been so successful in my hands as frequent irrigations and drainages, in which every care is taken, by oiling of catheters and careful manipulation to avoid traumatization. In those cases in which the inlying catheters were left in for a period of a few days so much edema developed that I seemed to get into the same situation that Dr. Quinby mentions, dragging out the convalescence to a period of two or three weeks, and sometimes longer.

Dr. J. A. C. Colston (Baltimore): I just want to say a few words about our experiences with intravenous use of mercurochrome in the treatment of kidney infection.

Of course, in the cases in which there is some mechanical factor (such as hydronephrosis or stone or ureteral obstruction) we do not attempt to use mercurochrome. In a few chronic cases of long standing, in which there are very few symptoms, in which the urine is infected and contains practically no pus cells, we have obtained results, but I think it is only fair to say that our results have been disappointing on the whole. But our results agreed with what Dr. Braasch said about the acute type of infection; that is, in many of those cases where the patient was having chills and elevation of temperature and the urine was infected and contained pus, very brilliant results were obtained by intravenous mercurochrome.

It seems that we can also pretty well prophesy what is going to happen, if the patient gets considerable reaction from the injection. That is, if the patient develops nausea, vomiting, shaking chills and elevation of temperature an hour or two after injection, we feel pretty confident that we are going to accomplish something. But if little or no reaction occurs, we feel sure that the result will not be as satisfactory.

Dr. Louis E. Schmidt (Chicago): I may not have got all the points in regard to Dr. Chute's paper, but as far as endocarditis is concerned in renal complications of the kidney, whether it is acute pyelonephritis or whether it is a so-called suppurative

nephritis—that is a question, of course, of differentiation—I have never seen a case of malignant endocarditis recover.

As far as Streptococcus viridans is concerned, I do not think there is a known case of recovery in connection with complications of the kidney, or even in the absence of any complications of the kidney. I have seen one case of Streptococcus viridans, with one complicating condition of the kidney.

In connection with the case that Dr. Kretschmer reported, he mentioned that he pulled some teeth. I do not know what good that does, because they are going to die, as sure as faith, even if we have mercurochrome present in the hospital. (Laughter.) I believe Dr. Young admits this.

I happened to try mercurochrome on a couple of cases, and those cases of mine terminated as all do.

In regard to acute pyelonephritis, discussed by Dr. Caulk, I rather agree with him on catheterizing in the acute condition. I do not know whether he mentioned it (I did not hear him) but I am in the habit of leaving the catheters in place for three to five days. During that period, I frequently give thorough lavage with antiseptic solutions; however, most frequently I use simply normal saline in large quantities irrigating oftentimes for days.

In regard to Dr. Braasch's reference to operative treatment of chronic pyelonephritis, I want to say this: that this is a point where we can use conservative surgery. It is the habit, if I am not mistaken (at least, I have seen it very frequently done), simply on account of the presence of pus to remove kidneys. We see that all the time wherever we go.

If there are some distinct symptoms, for instance, pain or hematuria, I think conservative surgery, particularly decapsulation, is indicated. Removing all the fibrous bands and adhesions around the blood vessels is essential: I think if this is done, circulatory conditions are greatly improved. There is no question that the patient receives a lot of relief from conservative work.

I only want to mention something here, in answer to Dr. Chute. I do not want to be misconstrued as waiting too long for these so-called perinephritic abscesses. I think that he rather misunderstood me. I do want to say, however, that the surgeons

I have reference to are of international reputation and are men of ability and they have failed to find perinephritic abscesses.

I have two such cases on record, within the past three years, which had been operated upon and the abscesses not found, where the condition persisted for a week or two longer, and where later another surgeon was called in and the abscesses were easily found and drained.

It is very well to say that you can do it, but there are unquestionably abscesses and abscesses, and sometimes you can not find them. That is all there is to it. (Laughter and applause.)

Dr. FRANCIS R. HAGNER (Washington, D. C.): We have been very much interested in pyelonephritis of pregnancy.

It has probably been the experience of all of us in these patients that the obstruction is present at the pelvic brim. We always have difficulty in getting the catheter by at that point. All of them have retention, and the first urine drawn out is invariably clear and is followed by urine so pussy that it is almost impossible to get it to run through a ureteral catheter. The patients that we had were very ill, with high temperature, and it was a question as to whether the pregnancies should be terminated or not. We were fortunate enough for this not to be necessary in any of our cases as they made a prompt improvement following the treatment.

We lavage the kidney and repeat it if necessary, following this treatment we have the patient assume the knee chest position for five minutes every two hours during the day and every four hours during the night. It is unquestionably a pelvic brim obstruction and when they take this position it tends to lessen the pressure of the uterus on the pelvic brim and allows the escape of the fluid from the pelvis of the kidney.

Many of these patients were running a temperature of 104 and 105 and were just as ill as they could be. Usually, within twenty-four hours their temperature would come down and in the majority of cases they would never have the high temperature again.

Dr. JOHN R. CAULK (St. Louis): In answer to Dr. Randall's question, let me say that I do not advocate pyelographic study in the very acute conditions. It is my custom to simply pass a catheter into the kidney pelvis to relieve the retention by aspirating the septic contents and instilling some antiseptic solution, preferably mercurochrome, into the pelvis; in certain cases it is necessary to leave in an indwelling ureter catheter; after all drainage is the important feature. Later on a thorough study may be made.

Concerning pregnancy, I feel that it is uterine pressure which is responsible for the infection. I do not believe that it is an intrinsic process in the ureteral wall itself as has been recently described; it impresses me that it is entirely a mechanical back-pressure.

We have examined a number of women during normal pregnancy, supposedly without renal symptoms, and have found that in over 50 per cent there was renal retention, most commonly on the right side. The question of therapy depends entirely upon the case; in some cases a simple catheter drainage with intrapelvic medication will clear up the condition, in other instances an indwelling catheter is necessary. I do not believe in irrigations or anything that has a tendency to stir up the inflammatory reaction. In any of these conditions, particularly in pregnancy, the relief of back-pressure, the relief of muscle stretching (muscles which have been stretched beyond their contractility), will in most instances relieve the condition without other manipulative procedures such as change of position, etc. It is quite surprising how promptly the muscles of the urinary tract from the kidney pelvis down will resume function when pressure is relieved.

The question of therapy depends entirely upon the case. We test them. We usually put the catheter in. It depends on the amount of retention also. If we get a great deal, and it is very dirty, we leave the catheter in. We do not irrigate any of these acute renal cases. We aspirate and instill some mild urinary antiseptic, but try not to stir up things at all. In the pregnancies, we feel that the relief of back pressure, the relief of muscle stretching (muscles which have been pushed out of tonicity, of contractility), will in many instances, without upside down positions,

allow the muscles to re-contract. It is really surprising how the muscles of the bladder and the muscles of the ureter or the renal pelvis will resume their functions when the pressure is removed.

Dr. WILLIAM C. QUINBY (Boston): Answering Dr. Chute, in regard to how we make estimations of the emptying time, it is done as follows: The patient lies on a table provided with two x-ray tubes, one above, the other below the table. After the catheter is in place, and the arrangement for filling the pelvis is adjusted, the room is darkened and the pelvis is injected until, on observation with the fluoroscope it looks adequately full. The injection having been stopped, fluoroscopic observation of the pelvis is continued either by eye or in a way which I feel is more accurate, by the making of multiple films, until you have made a half dozen or so. You may note thus how long after injection the pelvis remains full; or in other words its emptying time.

Does that answer your question?

Dr. ARTHUR L. CHUTE (Boston): It does.

Dr. QUINBY: There are several ways, I imagine, of accomplishing the same thing. I have only described the method we happen to use.

Dr. ARTHUR L. CHUTE: I assume, of course, your catheter is dragged down before you start.

Dr. QUINBY: Yes, but the degree of filling from which you start is estimated by observation first, so that you know you have something to empty.

Answering Dr. Townsend, in regard to plugging of the two-way catheter used for continuous ureteral drainage, I have not had any difficulty about clearing the catheters by suction. If you wish to be meticulously careful, you can fill the smaller side of the catheter before using it at all and see how much cubic contents that represents, and then inject only twice that amount.

It is quite easy to clear them, for the one side, that is, the administrative side, is always of the Number 5 size, whereas the outflow side varies in size according to the build of the catheter. I use a catheter with an outflow as large as I can use in the individual patient. I only showed you one example of catheter. We have some almost twice as large, or only half again as large.

Answering Dr. Randall, I do not feel any hesitancy about making pyelograms in properly selected cases. In an acute, fulminating case, of course, I would not make a pyelogram at that time; but if you observe it by fluoroscope and do not exceed a reasonable amount you can always inject sufficient medium without getting any deleterious reaction such as you spoke of. I think almost all such instances as those to which you refer, have been overinjected.

Dr. EDWARD L. KEYES (New York): How do you introduce the large catheter? I mean, what 'scope do you use?

Dr. QUINBY: Dr. Braasch's or Dr. Kelley's.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): The work that Dr. Quinby has done on the physiology of the ureter is very important. I was particularly interested in his observations on the physiology of diseased ureters. It opens an avenue for further investigation and it ought to be of value in determining the etiology of chronic renal infections.

Returning to the subject of dilating the ureter, to carry on the figure of speech which Dr. Livermore used a little further, I would say that the brick that was thrown was a gold brick. (Laughter.) I referred to the use of ureteral dilatation, it is true, but I will explain that in the last few years we have been dilating the ureters in every case of bilateral pyelonephritis in order to ascertain its value. I regret to state that I have yet to see a case where it was evident that a cure was obtained as the result of dilating the ureter.

I have come to the conclusion that although ureteral dilatation in the course of routine treatment of chronic bilateral pyelone-

phritis is probably of value, it should always be employed together with pelvic and bladder lavage, internal medication and removal of foci of infection.

The question may be asked, of how much permanent benefit are all of these methods? In answer it must be admitted that the patients unquestionably are improved both subjectively and objectively, and they usually come back for more treatment later. However, as far as actual cure is concerned, I question very much whether it is brought about by any of these measures.

In reviewing at Dallas some 1200 cases of chronic bilateral pyelonephritis (cases with a duration of symptoms over three to twenty years) which we had observed up to five years ago, I came to the same conclusion which we had come to from the clinical observation, namely; that a third of these patients will recover spontaneously or possibly aided by treatment; another third will improve, possibly as the result of treatment; and the remaining third will not improve from treatment and will become terminal.

Where these various methods of treatment are employed it would seem that we do increase the percentage of the first two groups, but that is about all that is accomplished, other than symptomatic improvement.

Strictures of the ureter accompanying chronic pyelonephritis as shown in the ureterogram are often more apparent than real. The ureter is tortuous and dilated in a great many cases as the result of inflammatory cicatricial changes rather than from actual obstruction.

The commentary made by Dr. Randall that he found two cases with positive Wassermann in his series of pyelonephritis is very interesting. We make a routine Wassermann in all our cases and none of the group I reported today had a positive Wassermann. So, apparently, it is a coincidental rather than an etiological factor.

The subject of chronic bilateral pyelonephritis is one in which much remains to be done, and I wish this Society would direct its attention toward solving some of the problems which have been raised.

FURTHER STUDIES ON THE TRANSPLANTATION OF THE KIDNEY[1]

CARL S. WILLIAMSON

Division of Experimental Surgery and Pathology, The Mayo Foundation, Rochester, Minnesota

The number of deaths in this country each year, directly attributable to the various lesions of the kidneys, is exceeded only by those due to cancer, tuberculosis, and heart disease. Each year has brought about some advance in our knowledge of diseases of the kidneys and their treatment, but unfortunately many renal lesions are not materially influenced by modern medical methods. This is particularly true of such lesions as those of bilateral tuberculosis, polycystic disease and hydronephrosis, with or without infection, resulting from some mechanical obstruction. These lesions are often seen in relatively young persons who are in otherwise normal health, and if some method for replacing the injured kidneys with new ones could be devised they might have a better life expectancy.

In 1920 I began a series of experimental studies on transplantation of the kidney to determine, if possible, whether something could not be done to alleviate the suffering and prolong the productive existence of those afflicted with the so-called inoperable surgical diseases of the kidneys. By surgical diseases of the kidney I mean those bilateral lesions which might be cured provided both kidneys could be removed and replaced by the transplantation of normal ones.

The experiments were performed on dogs and goats. The operative work was done with the animals under ether anesthesia, and rigidly sterile operative technic was employed. Since

[1] Abridgment of thesis submitted to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirement for the Degree of Master of Science in Surgery, 1926.

the technic for all types of kidney transplantation has become essentially a standardized procedure, a single description will suffice for all. Our transplants have, in the majority of experiments, been made into the neck, but since some of the older writers, particularly Carrel and Guthrie (2, 5), have stressed the importance of placing the transplant within the abdominal cavity, I have also done a number of experiments of this type, and a brief description of this technic also will be given.

It is my purpose at this time to report in a general way my recent observations and at the same time to emphasize the histologic changes that occur in the transplanted kidney following the various types of transplantation.

TECHNIC OF EXPERIMENTS

All operations were performed under ether anesthesia, employing sterile technic. A straight incision, parallel with the external jugular vein and extending from the level of the hyoid bone down to the sternoacromial juncture, is made. The jugular vein is dissected free from its bed and the small tributaries are ligated (fig. 1). Then a crushing clamp is placed on the vein at the upper angle of the wound and a second crushing clamp applied 5 or 6 cm. above the lower angle of the wound. A bulldog clamp with padded blades is placed on the vein at the lower angle of the wound. The vein is then divided proximally to each of the crushing clamps, and the distal stump is ligated and allowed to drop back into the wound while the lower end is prepared for suturing by removing the adventitia. The carotid artery is prepared in the same manner as the vein. Following preparation of the vessels for suturing, a muscle pocket for the reception of the kidney is made by separating the muscles lateral to the trachea and spine.

After the vessels of the recipient have been prepared for suturing, a long median-line incision is made in the donor, and the left kidney with its vascular pedicle is dissected loose with as little trauma as possible to the kidney. When the kidney and its vessels are freed, the kidney is gently lifted upward and

clamps applied first to the artery and then to the vein as close to the aorta and vena cava as possible. I have found a bifurcation in the renal artery of the dog in the great majority of experiments, but it has usually occurred sufficiently high in the artery to permit an anastomosis proximal to it. The vessels are always divided with a sharp knife in order to lessen the amount of trauma to the intima and thereby reduce the likelihood of thrombosis. After the vessels have been divided, the

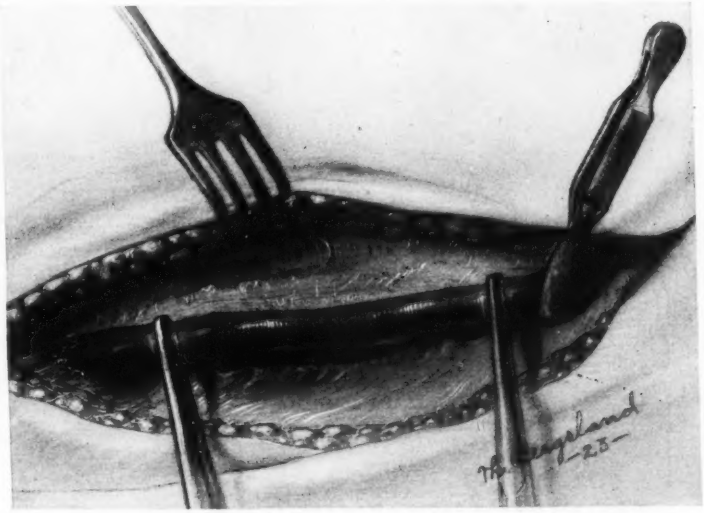


FIG. 1. CLAMPS IN PLACE ON EXTERNAL JUGULAR VEIN PREPARATORY TO REMOVAL OF SEGMENT FROM VEIN

kidney is wrapped in a warm salt sponge and carefully lifted up while the ureter is dissected out. The ureteral dissection is carried downward until about two-thirds of it has been freed, and then divided.

The kidney is then moved to the site of implantation and the renal vessels prepared for anastomosis in the same manner as the jugular vein and carotid artery. The renal artery is sutured to the carotid artery and the renal vein to the external jugular

vein. The arterial anastomosis is always made first, as it is the deeper of the two. The anastomosis of the blood vessels is made by our modification of the Carrel-Guthrie technic which, roughly, consists of the use of three guide sutures (fig. 2) pene-

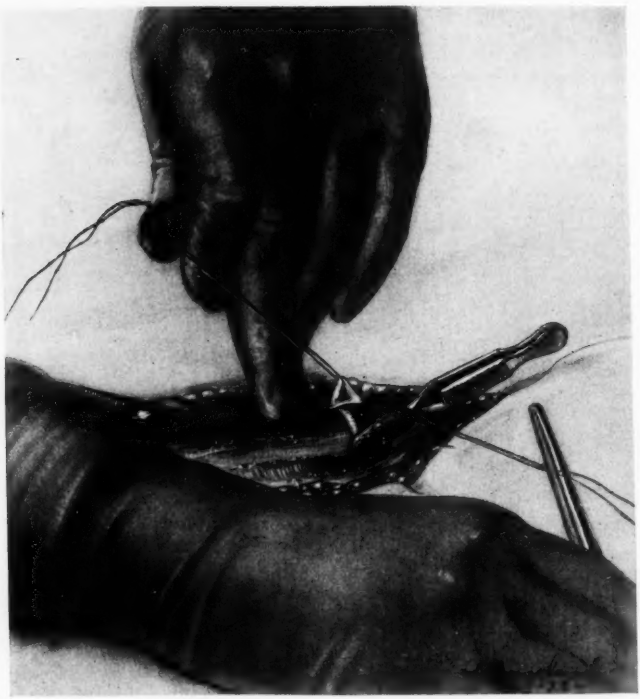


FIG. 2. WALL OF VESSEL DISTENDED INTO A TRIANGLE BY THREE GUIDE SUTURES

By penetrating both ends of the severed vessels with these guide sutures, the vessel walls are easily distended and held taut, thus facilitating the making of the anastomosis.

trating both the remaining coats of the vessel, and so placed as to divide the vessel as nearly as possible into three equal triangles. These guides are held by an assistant in such a manner as to distend the walls of the vessel into triangles. A continuous

through-and-through suture of fine silk is used for uniting the vessels. When one side of the triangle has been sutured, the guides are rotated so that the suturing is always done on the top side of the triangle. From time to time a few drops of sterile liquid petrolatum are dropped on the suture line, as it is being made, to prevent drying. The vein is sutured in the same manner as the artery. When the anastomoses have been completed, the clamp is first removed from the external jugular vein, and then the carotid artery. Most of the anastomoses do not leak enough to be of any concern, but sometimes it is necessary to take an additional suture, either in the vein or artery. The length of time that the kidney has been without a blood supply is always recorded, and is counted as being the interval that the transplant is without a blood supply in the donor and recipient. When no further bleeding occurs from the suture lines a ureteral catheter is inserted into the ureter, well up into the pelvis of the kidney, and then withdrawn until it is just at the ureteropelvic juncture. This catheter is then tied in place with a catgut ligature around the distal end of the ureter. The ligature retains the catheter and controls the ureteral bleeding. A muscle pocket is made by separating the muscles lateral to the trachea and spine, and the kidney is dropped into the pocket. Care must be taken at this point to prevent kinking or twisting of the vascular pedicle and to see that the vessels are not constricted by the ureter. The ureter is then carried across to the other side of the neck and out through a stab wound in the skin. A few interrupted catgut sutures are used to close the muscles and hold the kidney in place. The skin is closed with a continuous linen suture and covered over with a strip of collodion gauze. A silk suture is used to fix the ureter to the edge of the stab wound, and the ureter covered with a sterile gauze sponge to protect it while the animal is coming out of the anesthesia. Urine is usually beginning to appear from the catheter by the end of the operation. The catheter is left in place from twenty-four to thirty-six hours, after which time the danger of edema blocking the drainage has usually passed.

In 1908, Carrel (2, 5, 6) in reporting his experiments on kid-

ney transplantation, called attention to the superiority of the abdominal over the cervical region as a site for the transplantation of the kidney. This author used cats for much of his experimental work and was able to cite one homogenous block transplant which functioned for more than one month. In these experiments Carrel and his coworkers divided the aorta and vena cava just below the renal vessels in the donor and into this gap sutured a segment of the aorta and vena cava containing the renal vessels and kidneys. The ureters and a segment from the trigone of the bladder were also transplanted. After the anastomoses were completed, the animal's own kidneys were excised. This region for the transplantation offers many technical hazards not encountered in the cervical region, but since some success seemed to have been attained by using it, I have also done a number of experiments in this region.

My technic has been somewhat less involved than that used by Carrel, but has seemed to meet the requirements of at least temporary success. The aorta and vena cava are freed in the donor for a distance of about 6 cm. above the bifurcation of the iliac vessels (figs. 3 and 4), the small tributaries being ligated to permit greater mobility. After the vessels of the recipient have been dissected free, a block of aorta and vena cava containing the renal vessels and kidneys is removed from the donor. This block is usually from 2 to 3 cm. in length. The ureters are freed for about two-thirds of their course and divided. The entire mass is then moved to the recipient, bulldog clamps are placed on the aorta and vena cava, both above and below the site of the proposed implantation, and the vessels divided with a sharp knife. After division, the vessels retract just enough to allow a satisfactory interposition of the block. Thus, excessive tension on the suture line or relaxation of the vessel walls due to lack of tension is avoided. The blood vessels are sutured in the same manner as in the cervical region. Following the completion of the anastomosis, which usually required from forty-five to fifty-five minutes, the blood is released and the kidneys immediately assume a normal appearance. Suturing of large vessels, such as the aorta and vena cava, is quite as satisfactory

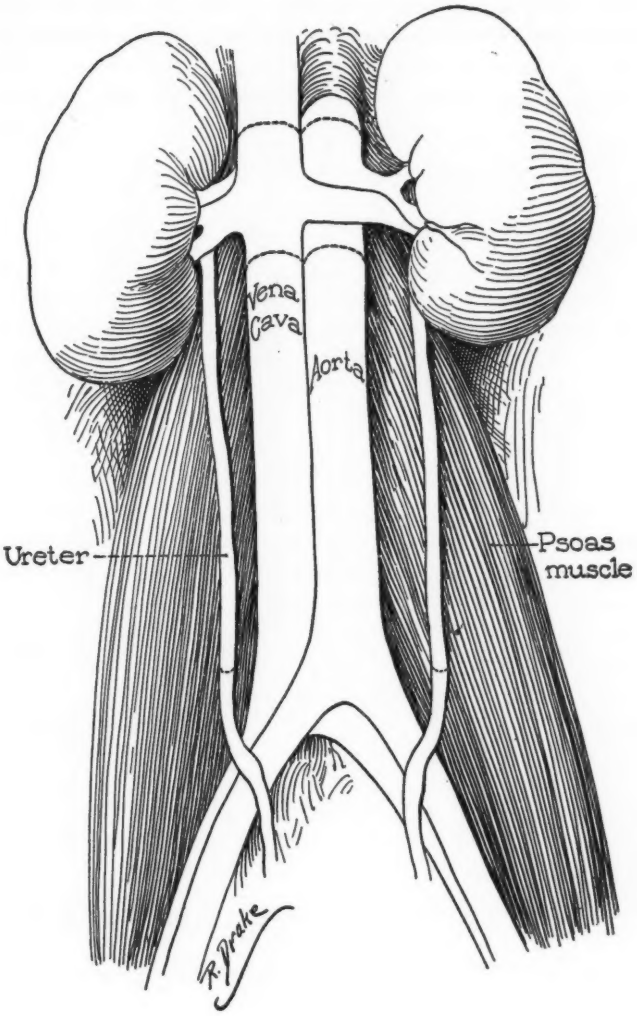


FIG. 3. SEGMENT OF AORTA, VENA CAVA, AND URETERS TO BE REMOVED FOR BLOCK TRANSPLANTATION

as the suturing of smaller vessels. After the vascular suturing is completed, two methods for disposing of the ureters of the

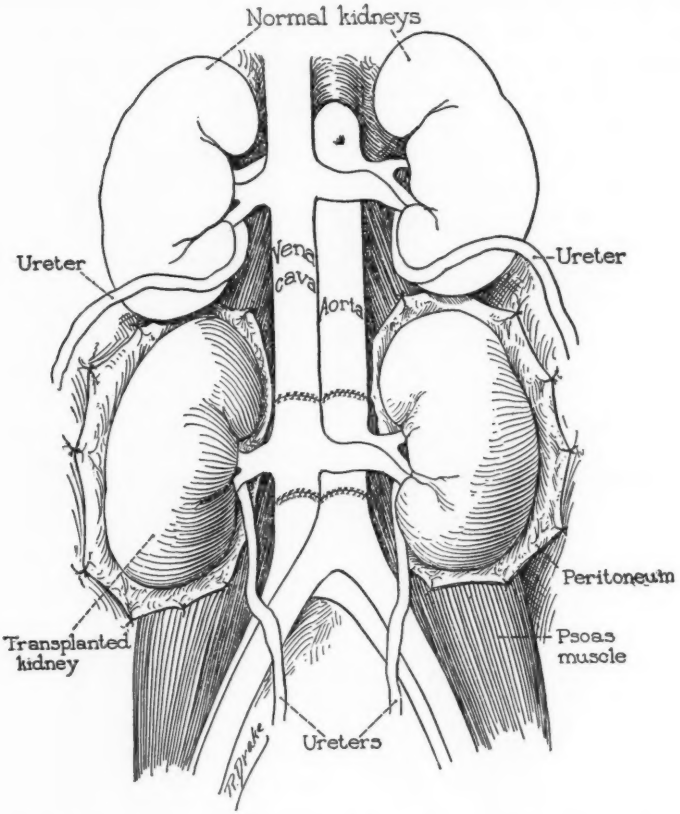


FIG. 4. BLOCK OF AORTA, KIDNEYS, VENA CAVA, AND URETERS AFTER TRANSPLANTATION

The transplanted kidneys are held in place by a few interrupted catgut sutures attaching the perirenal tissue to the peritoneum.

transplant are available. The animal's own ureters may be divided and a bilateral ureteral anastomosis made, or one trans-

planted ureter may be brought out either flank of the animal through a stab wound. When a bilateral ureteral anastomosis is made, the recipient's own (normal) kidneys must, of course, be removed, but when drained to the outside, they may be left in.

AUTOGENOUS TRANSPLANTATION

Results of experiments

All of my autogenous implantations were made into the cervical area. The majority of the transplants began to excrete at the conclusion of the operation. The excretion at first was slow and periodic; often it was possible to observe the peristaltic wave in the ureter. But within a few hours the excretion rapidly increased until at times there was almost a small stream of urine. As the rapidity of excretion increased the visible effects of peristalsis decreased. Rapid excretion of urine in such experiments, however, does not last for a prolonged period and may be only relative unless the normal kidney has been removed at the time of implantation. The rate usually begins to decrease on the second or third day, and thereafter from 5 to 15 drops of urine a minute are excreted. This rate may be increased either by removal of the remaining normal kidney or by causing the animal to take large quantities of water. Because of the obvious slowing up in the rate of secretion after a few days, I have found it best to remove the normal kidney on the third to the fifth day if the experiment is to be of long duration. By this time any danger from a surgical accident, such as thrombosis of the vessels, infection of the wound or obstructed drainage of the ureter, is likely to have passed. Any one of these complications may occur but after the fifth day they are very rare. Once having passed the so-called critical stage the implanted kidney will continue to maintain the life of the animal in a practically normal way for a long time after the normal kidney is removed.

The longest time that an autogenous kidney transplant has survived following removal of the remaining normal kidney in

my series of experiments has been nine months. The cause of death of the transplant has usually been due to poor drainage secondary to cicatricial contraction of the ureter associated with an overgrowth of the ureteral opening by the skin. These complications are both preventable with careful attention, and such transplants if properly watched should maintain the animal under normal living conditions for many months.

The urinary output from these implants varies from time to time in quantity and quality. It may be either acid or alkaline. The specific gravity varies between 1.008 and 1.020. It may or may not contain casts and albumin. A small amount of albumin is noted in about 80 to 90 per cent of all animals experimented on. Excretion of phenolsulphonephthalein usually appears in from forty-five to ninety seconds after intravenous injections. If it does not appear for more than one and one-half minutes there is often an obstruction of drainage. The urea content is practically the same in urine from the normal kidney and the transplant. The quantity of urine from the transplant during the first few days is greater than that from the normal kidney.

Histology

The histology of the implanted kidney during the first few days differs little from what one would expect following so much manipulation. Within the first eighteen hours after operation there is some edema of the tubules and rather marked congestion in the cortex. The cells lining the tubules are apparently intact, and the glomeruli, though somewhat congested, are in good condition (figs. 5 and 6). In the tubules there is, however, a varying amount of hyaline-like material that is in all probability coagulated blood serum. The source of this material and its effect on the transplant are unexplained. It does not seem that the serum, if it is serum, escapes by way of the glomeruli, as in none of my sections have I ever been able to detect any of it in or around the glomeruli. It most probably is an exudate either from the tubular cells per se or blood serum escaped from these cells. This hyaline-like material is probably the source

of the albumin in the urine from these kidneys. Albumin is always most abundant in the urine during the period of time that the tubules contain the largest amount of hyaline-like material, that is to say, within the first forty-eight to seventy-

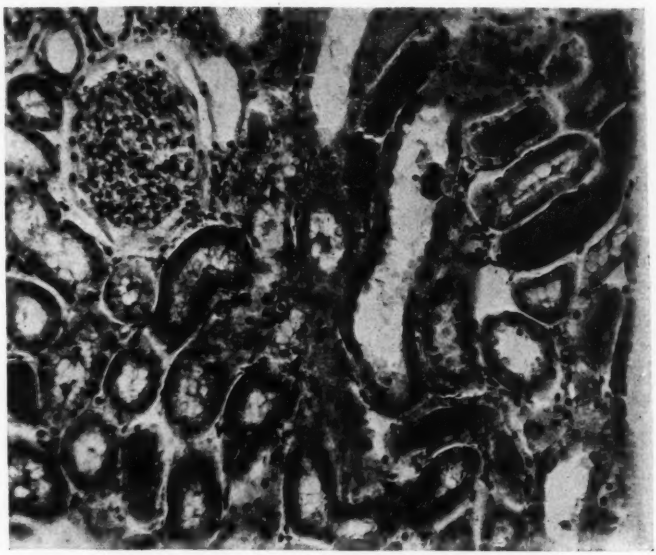


FIG. 5. AUTOGENOUS KIDNEY TRANSPLANT IN PLACE TWENTY-NINE AND ONE-HALF HOURS

Excretion excellent. Aside from hyaline and albumin in tubules, with some cloudy swelling, kidney almost normal in appearance. (× 120.)

two hours after operation. As the functional life of the transplant proceeds there is but little change in the histologic picture. But when the kidney begins to fail the usual picture of hydronephrosis and infection supervenes. So long as there is free drainage the amount of polymorphonuclear infiltration is slight; when the drainage becomes impeded and slow the cellular signs of infection quickly appear and it is not long until failure becomes evident in the form of enlargement of the kidney. There

is forceful ejection of the urine (at times projected several feet); the urine becomes cloudy and contains many pus cells, and the blood urea increases, while the animal fails and gradually dies from the effect of renal insufficiency.

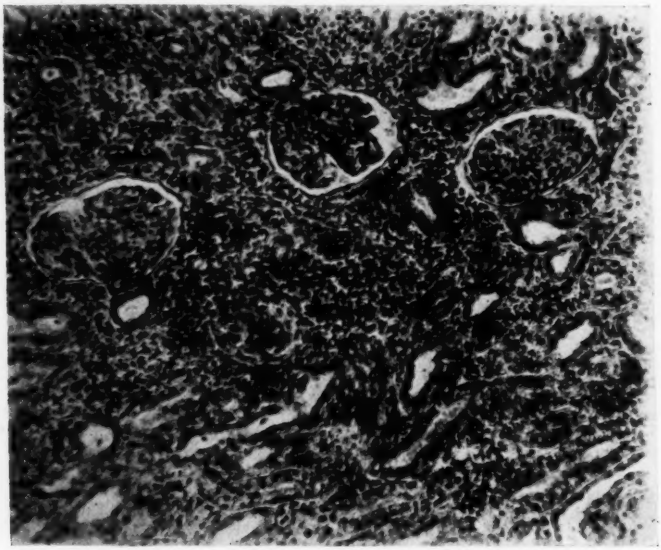


FIG. 6. AUTOGENOUS KIDNEY TRANSPLANT IN PLACE TWENTY-FOUR DAYS

Marked polymorphonuclear infiltration. Many glomeruli destroyed. Some tubules blocked and others destroyed as a result of hydronephrosis and secondary infection. (× 120.)

HOMOGENOUS TRANSPLANTATION

From the beginning of this research, my attention has been primarily centered on the behavior of the homogenous kidney transplants, because it has seemed that transplantation of the kidney to any region, to be of value clinically, must be of this type. The autogenous type of kidney transplant, however, serves admirably as a control for these more important experiments, and it seems safe to assume that the success attained with controls could be duplicated in the experiments with homog-

enous transplants, provided this success is entirely dependent on the location of the transplant and operative technic.

In the experiments with homogenous transplants I have employed exactly the same rigidly aseptic operative technic as in

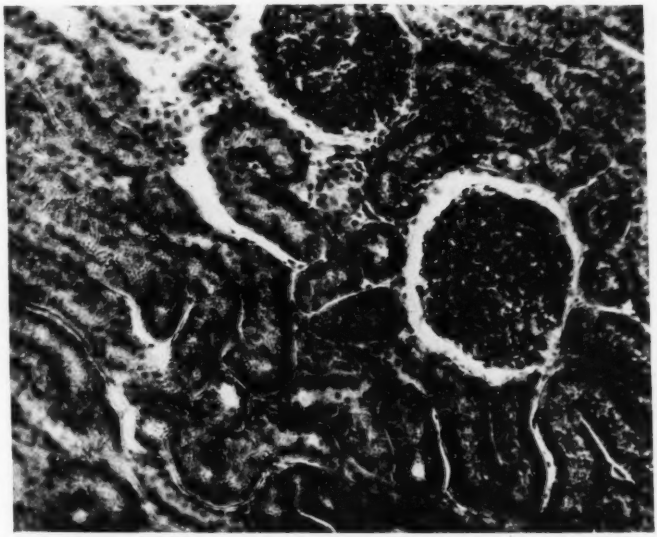


FIG. 7. HOMOGENOUS TRANSPLANT IN PLACE TWENTY-FOUR HOURS

Excretion excellent. Slight general congestion, some swelling of glomeruli, many tubules filled with albumin, cellular outlines good. Kidney practically normal. (× 120.)

the experiments with autogenous transplants, the only difference in the two types being the use of a donor in the former. These donors were chosen at random from the animals in the laboratory, and in most instances the possibility of breed or blood relationship between recipient and donor was extremely rare.

Results of experiments

The average time that the transplanted kidney was without a blood supply has been twenty minutes. In a high percentage

of all the experiments urine was beginning to be discharged at the conclusion of the operation. Within three to four hours after operation the urinary output markedly increased in amount and assumed fairly normal characteristics. The quantity of

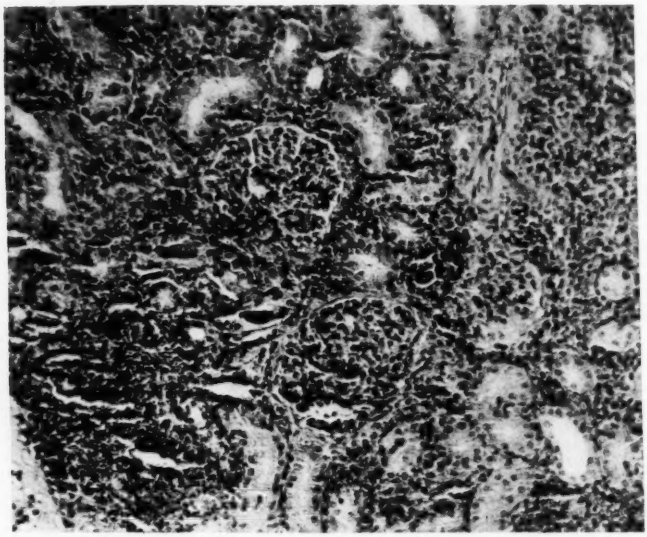


FIG. 8. TAKEN FROM HOMOGENOUS TRANSPLANT IN PLACE ONE-HUNDRED AND TWENTY HOURS

After almost complete cessation, intense glomerulitis, acute congestion and some cellular failure, marked lymphocytic infiltration. Many tubules filled with a hyaline-like material. (× 120.)

urine excreted for a unit of time by the transplanted kidney during the first day of functional life was often as great and sometimes greater than the combined output of both normal kidneys would have been. This urine, however, is often of a low specific gravity, 1.008 to 1.010. At first it is alkaline or neutral, although it may later become acid, and it contains some albumin. Red blood cells are usually present in the beginning and at the end of the functional life of the transplant. The quality of the

urinary excretion within the first twelve to twenty-four hours of transplant activity does not differ to any extent from that of the autogenous implants. During the period of time that the implanted kidney is functioning satisfactorily, the animal is able to enjoy the usual canine activities.

But the similarity of behavior between the autogenous and homogenous kidney transplants is of but short duration. The homogenous implant seems to function perfectly for from one and ten days. During the time that the function is satisfactory, the transplant responds to all tests of function such as diuretics phenolsulphonephthalein, elimination, urea elimination, and the maintenance of the animal in a normal condition if the normal kidneys are removed. If the normal kidneys are in place, however, I have observed a marked lowering of the blood urea from normal.

In all of my experiments, sometime between the first and tenth day, usually about the fourth, a slight increase in the size of the kidney is noted. Just before or soon after enlargement occurs, the rate of excretion begins to diminish. The urinary output may fail slowly or quite rapidly. In fact anuria developed so quickly in many of the experiments that I was led to believe that some impediment to drainage had occurred. Catheterization reveals no retention or only a few drops of a blood-stained turbid fluid. Coincident with this failure in excretion if the normal kidneys have been removed at the time of, or subsequent to, the kidney implantation, the determination of blood urea shows that the urea nitrogen is mounting. As the anuria continues, stimulation by any of the previously effective diuretics is without result, and the animal gradually falls into uremia and dies within forty-eight to seventy-two hours after the onset of the anuria.

In the hope of solving the riddle of why the autogenous transplant survives, and the homogenous one fails, I have removed the transplanted kidneys in each type of experiment at varying periods after transplantation for histologic study. The agent that is responsible for the destruction of the homogenous kidney transplant seems blood-borne, and apparently attacks first the

glomeruli and then the tubules. This observation is substantiated by the intense glomerular reaction in practically all of the transplants in which failure of function is imminent and in which there is associated edema of the tubules. There is more or less general lymphocytic infiltration. It is impossible to draw conclusions from a small series of experiments as many factors enter into the picture each hour after the functional life of the transplant begins to fail.

Histology

For the purpose of illustrating and emphasizing my point the results of numerous experiments will be summarized and given as typical of one experiment. As long as excretion is good, as evidenced by the quantity and quality of the urine, and the blood urea remains normal, the homogenous kidney transplant will show on section a moderate amount of edema of the tubules and perhaps some hyaline-like material in the collecting tubules. This picture corresponds to that of the early autogenous kidney implant. Without any perceptible change in the secretion of the kidney a later slide will show early glomerular changes and some lymphocytic infiltration, but little change in the tubular elements. Another section taken slightly later still, whether or not there are perceptible urinary changes, will show the glomeruli more intensely congested and perhaps a few red blood cells escaping. The time when the section is taken determines the degree of glomerular injury. Coincidently with these pictures some changes are noted in the tubules. They become more swollen, the nuclei are poorly stained, and some tubular cells are actually degenerating. The lymphocytes may increase or remain about stationary in number. A few polymorphs begin to appear. A specimen taken from a kidney, just a few hours older than the one last described, might show either of two things: a predominating glomerular type of injury or an overwhelming tubular injury. The type shown has seemed to me to depend on whether the cessation of function is rapid or relatively slow. Certain it is that the change from a predominating glomerular to tubular injury is rapid. Hand in hand with

the change from glomerular to tubular destruction appears a third destructive element, namely, an ascending infection. This may result in the formation of abscesses (rarely cortical) or be followed by the gradual replacement of the renal substance by fibrous tissue, provided the kidney is allowed to remain in place. An ascending infection, so far as I have been able to determine from my studies, does not begin until the physiologic changes in the transplant begin to impair and diminish the urinary output.

HETEROGENOUS TRANSPLANTATION

Results of experiments

My experiments with heterogenous transplants have been limited to only two. However, since both recipients died within a few minutes after the release of the circulation through the transplants, I have been led to believe that not much progress can be made with such transplants, especially if the experimental animals used are dogs and goats. In my experiments I used goats for the donors and dogs for the recipients. The recipients died from what seemed to be an anaphylactic-like reaction. Histologic specimens from the transplanted kidney revealed that the organ was filled with clumped red blood cells. In fact the vessels appeared to be plugged with these tightly clumped cells. There was no evidence of coagulation or clot formation.

DISCUSSION

My observations on the survival of the autogenous kidney transplant coincide with those of numerous previous workers (1, 9, 10). Such a transplant will maintain the life of the experimental animal in a practically normal manner for months after excision of the other, normal kidney. The location of transplant, in the cervical region, subjects it to injuries and disturbances not encountered within the abdomen, but despite these factors it will function and support life for many months. Any ill effects suffered from division of the nerve supply are

certainly not apparent. Autogenous transplants, while of great scientific interest, are most important as accurate controls for the more practical homogenous kidney transplants.

The most optimistic reports of successful homogenous kidney transplantation were made by Carrel and Guthrie together and separately between 1905 and 1910 (3, 4, 5, 6). These authors, after trying the cervical region as a site for implantation, felt that the failures occurring in this region were perhaps due to an unfavorable location and because of this, devised and used an abdominal mass transplantation. With this they secured somewhat better results, but here too the survival was of limited duration, although the final report has not yet appeared. These authors seem to favor location and surgical accidents as the principal causes of failure in their experiments.

Dederer, who performed numerous experiments in this laboratory between 1918 and 1920, finally had one homogenous transplant, in which recipient and donor were sisters, that survived twenty-six days after removal of the normal kidneys. The animal died of distemper at the end of this time. Holloway, working in this laboratory more recently, has accurately observed the effect of the various diuretics on both the autogenous and homogenous transplants. He noted that both groups respond to these stimuli, but that diuretics hasten the failure of the homogenous implants.

Ibuka made a painstaking study of the urinary constituents in the two types of transplants and found them to be essentially normal in each for a time, but this was of short duration because of the early failure of the homogenous group.

In my preliminary report (12) I called attention to the fact that factors aside from the surgical difficulties and the location are involved in the failure of homogenous transplants. It now seems from the data here presented that this failure is per se dependent on severe and destructive atypical glomerular nephritis. This, as has been pointed out, is of relatively short duration and is quickly succeeded by acute general nephritis which in turn is followed by an ascending general infection and destruction of the renal tissue with occasionally some attempt at replacement

by fibrous tissue. A painstaking histologic study of these changes has, I believe, never been attempted previously.

The cause of the primary lesion is without doubt a blood-borne agency, the exact nature of which we can as yet but guess. But it seems to be most closely associated with the fundamental biologic relationship of the animals studied. A possible explanation of the variation in the length of survival of the various transplants is that the donor and recipient in certain cases are biologically more closely related than we have had reason to suspect. It is, therefore, possible that some one will sometime hit upon two animals that are so closely allied that their organs may be interchangeable. This hypothesis is greatly strengthened by the relatively long life of transplants reported by Carrel (2) (thirty-seven days) and by Dederer (twenty-six days). Were it possible to classify the experimental animals by blood grouping it should be fairly easy to establish the truth or falseness of this supposition provided tissue grouping corresponded to blood grouping, a fact not as yet established. Recently some progress seems to have been made in this direction by a classification of a blood-grouping basis of the higher monkeys, and were these animals not so difficult to obtain and care for in our climate, they might afford a solution to our problems.

The status of kidney transplantation from a clinical viewpoint remains much in doubt. But other factors being equal, and if death is inevitable within a short time from some surgical lesion of the kidneys, I believe that if a satisfactory donor is available transplantation would at least offer the remote possibility of great gain, and but little would be lost. The life expectancy of the recipient in such a case must perforce be very short. The kidney should be taken from a donor killed in an accident or from one who died from some condition not in any way involving or likely to influence the kidneys, a brain tumor for instance. The donor and recipient should be grouped by the direct method to be sure that no incompatibility exists in the blood, and the transplant should be made within one or two hours, at most, after the death of the donor; the sooner it is made, the greater the chance of success. It would seem advisable to make the

implantation in the femoral or inguinal region and by an end-to-side anastomosis so that if it became necessary to remove the transplant, it could be easily done without sacrificing the blood supply to the limb. The ureter could be left long and in case of success could later be implanted into the bladder although a urinary fistula would be preferred to death by most persons. The whole operation could be done under local anesthesia and should not materially hasten death if unsuccessful. Perhaps such an operation may never either be attempted, or succeed if attempted, but progress is not made without effort, and the end of the experimental road in this matter, from a technical standpoint, has been reached, and from a biologic standpoint it is certainly closed with our present knowledge.

PROTOCOLS

Experiment 1, dog F799. The animal experimented on was a male dog of medium size, weighing 12 kgm. The skin incision was made at 9:53 a.m., October 24, 1922, and the last stitch was taken at 11:15 a.m. The blood vessels in the neck were prepared for suturing. A median-line incision was then made and the left kidney removed for transplantation into the neck. The renal artery was anastomosed to the carotid artery and the renal vein to the external jugular vein. The ureter was brought out on the left side of the neck through a stab wound. The transplanted kidney was secreting at the conclusion of the operation. Secretion by this kidney was still good the next day. It was removed twenty-nine and one-half hours postoperatively. Circulation was good and there was no evidence of infection at this time.

Microscopic study revealed slight edema, normal-appearing glomeruli, tubules slightly smaller than normal, and many of them filled with a hyaline-like material, focal areas of lymphocytic infiltration, and a very few polys in the peripelvic area. The diagnosis was a normal kidney with slight edema.

Experiment 2, dog F649. A mongrel dog was used in this experiment. The incision was made at 8:12 a.m., August 18, 1922, and the last stitch was taken at 9:30 a.m. An autogenous kidney transplantation was carried out by the customary technic. There was no leakage when the clamps were removed, releasing the circulation, and the kidney

seemed well implanted. Vascular circulation was not impeded two hours after operation, as urine was being discharged at the rate of 18 drops each minute. The urine was free from blood but slightly turbid.

Function remained good following transplantation. August 26, the blood urea was 16 mgm. for each 100 cc.; the normal kidney was removed. August 29, function was good; blood urea, 80 mgm. for each 100 cc., September 1, 46 mgm., and September 4, 34 mgm. September 6, drainage was not so good; some swelling of kidney was noted; animal was not so active. September 8, there was marked swelling of neck; ureter being projected from ureter; animal in poor condition. September 12, the animal died during the night, twenty-four days after transplantation. The kidney was greatly distended with a cream colored fluid. The blood vessels were patent; the ureter was free but passed under sternothyroid muscle, hence under some compression. On section the kidney was found to contain about 200 cc. of fluid; very little of the cortex remained. The gross diagnosis was hydronephrosis with infection.

Experiment 3, dog F710. A medium-sized female mongrel, weighing 10.3 kgm. was used. The incision was made at 10:40 a.m., September 20, 1922, and the last stitch was taken at noon. The vessels on the right side of the neck were prepared for suturing. The left kidney was removed from dog F711 and transplanted into the neck by anastomosing the renal artery to the carotid artery, and the renal vein to the external jugular vein. Circulation was shut off from the kidney for twenty-seven minutes. There was no leakage from the suture lines. The ureter was brought out through a stab wound on the left side of the neck. There was secretion at the conclusion of the operation, and twenty-four hours afterward the kidney was secreting nicely and was removed. The circulation through the transplant was excellent and externally the kidney appeared normal.

Microscopic study showed the general appearance to be normal except for small focal areas of lymphocytic infiltration, and one small infarction. The diagnosis was a normal kidney.

Experiment 4, dog F642. The dog used was a male fox terrier, weighing 10.5 kgm. The skin incision was made at 8:30 a.m., August 16, 1922, and the last stitch was taken at 9:50 a.m. The blood vessels of the neck were exposed and prepared for suturing. The left kidney was removed from dog F643 and transplanted into the cervical region

of this animal. The renal artery was anastomosed to the external carotid artery, and the renal vein to the external jugular vein. On release of the circulation there was very little leakage from the suture lines. The ureter was brought out through a stab wound on the left side of the neck and held in place with a catgut suture. Urine was discharged at the conclusion of the operation. The secretion was excellent for ninety-six hours; between ninety-six and one hundred twenty hours secretion began to diminish, and at the end of one hundred twenty hours only a small quantity of light amber-colored urine was excreted. The kidney was removed August 21. It was somewhat enlarged and presented no external evidence of infection. Circulation was excellent. On section the kidney was dark in color, especially the cortex. There was slight dilatation of the pelvis, but no evidence of pyelitis.

Microscopic study revealed acute general congestion 3 and glomerulitis 3. There was peripheral infiltration, about equally divided between the lymphocytes and the polys, and a rather diffuse lymphocytic infiltration. The tubules were edematous, and many were filled with a hyaline-like material. Some seemed to be desquamating. The diagnosis was acute glomerulonephritis.

CONCLUSIONS

1. An autogenous kidney transplant will maintain the life of the experimental animal for months after removal of the other normal kidney.
2. During the time that the autogenous kidney transplant is functioning the urinary constituents are essentially normal and the animal behaves and lives normally.
3. Failure in this type of experiment is due to hydronephrosis and infection.
4. Homogenous kidney transplants function as do the autogenous ones, but only for a period of days except in rare instances.
5. The blood urea of an animal with three functioning kidneys, two normal and one transplanted, is markedly reduced.
6. The location of the transplant does not materially lengthen the functional life or influence the terminal histologic picture.
7. The histologic picture in this type of experiment is that of acute atypical glomerular nephritis followed by general acute nephritis.

8. Infection as evidenced by the cytologic changes is not a factor in these experiments so long as good drainage and function are maintained.

9. If the transplanted kidney is allowed to remain in place after anuria develops there is a tendency for it to be replaced by fibrous tissue.

10. The failure of homogenous kidney transplants seems attributable to a biologic incompatibility between the donor and recipient.

11. The value of kidney transplantation as a clinical measure is questionable with our present knowledge, although under proper conditions it might be worthy of serious consideration.

REFERENCES

(1) Carrel, Alexis: La technique opératoire des anastomoses vasculaires et la transplantation des viscères. Lyons méd., 1902, xcviii, 859–864.

(2) Carrel, Alexis: Transplantation in mass of the kidneys. Jour. Exper. Med., 1908, x, 98–140.

(3) Carrel, Alexis: Remote results of the replantation of the kidney and spleen. Jour. Exper. Med., 1910, xii, 146–150.

(4) Carrel, Alexis, and Guthrie, C. C.: Functions of a transplanted kidney. Science, 1905, n.s., xxii, 473–565.

(5) Carrel, Alexis, and Guthrie, C. C.: Successful transplantation of both kidneys from a dog into a bitch with removal of both normal kidneys from the latter. Science, 1906, n.s., xxiii, 394.

(6) Carrel, Alexis, and Guthrie, C. C.: Anastomosis of blood vessels by the patching method and transplantation of the kidney. Jour. Amer. Med. Assoc., 1906, xlvii, 1648–1651.

(7) Dederer, Carleton: Successful experimental homotransplantation of the kidney and ovary. Surg., Gynecol. and Obstet., 1920, xxxi, 45–50.

(8) Dörfler, Julius: Ueber Arteriennaht. Beitr. z. klin. Chir., 1899, xxv, 781–825.

(9) Holloway, J. K.: The effect of diuretics on transplanted kidneys. Jour. Urol., 1926, xv, 111–131.

(10) Ibuka, Kenji: Function of the homogeneous kidney transplant. Amer. Jour. Med. Sc., 1926, clxxi, 420–433.

(11) Ullmann, Emerich: Experimentelle Nierentransplantation. Wien. klin. Wchnschr., 1902, xv, 281–282; 707.

(12) Williamson, C. S.: Some observations on the length of survival and the function of homogenous kidney transplants. Jour. Urol., 1923, x, 275–287.

DISCUSSION

Dr. WILLIAM C. QUINBY (Boston): I think you can hardly realize, gentlemen, unless you have attempted such work yourselves, the enormous amount of meticulous care necessary in making a successful vascular anastomosis, under the conditions found in dogs; and I am sure you will agree with me that Dr. Williamson is to be highly congratulated on his persistency in developing his technique.

He, too, has found, as I did and others have, that a kidney belonging to a dog may be re-implanted in some other portion of that individual dog's anatomy, with complete success. I think you carried your cases along for many months, didn't you?

Dr. CARL S. WILLIAMSON: Yes, nine months.

Dr. QUINBY: I kept one of my dogs alive for three years. He was quite normal all the time, living on a single kidney which had been first removed and later replaced in the body by vascular and ureteral suture. So we may say, I think, that today the technique of these procedures is sufficiently well developed.

The question which is far from being solved, however, and one of which we can only get glimmerings of answers is the underlying biologic reason as to why a foreign kidney (that is, one foreign to the individual) may not live, when so united by vascular suture. As far as I can see (I can only speculate), the reasons are probably to be found in the realm of serology. There can be no histological differences of any consequence, but the same reason or an analogous reason why these kidneys do not live underlies the transplantation of even so undifferentiated a structure as skin. I mean heteroplastic skin-grafts do not stick, and the same thing is true of kidneys.

It is very important, however, that facilities be maintained for this type of work, and it is also important that such assiduous workers as Dr. Williamson be encouraged to keep at it, because there is no doubt whatever, although none of us here may live to see it, that such procedures will be successful some time in the future.

URETEROCELE

WITH REPORT OF A CASE

FRANK S. PATCH

From the Department of Urology, Montreal General Hospital

NOMENCLATURE

In reviewing the considerable literature of this condition, one is struck by the confusion of terms, and lack of unanimity displayed by the various writers on the subject. Cystic dilatation of the lower end of the ureter is the term most commonly used. Among other terms employed are cyst of the lower section of the ureteric tube, uretero-vesical cyst, intra-vesical ureteral cyst, cystocele, prolapse of the vesical end of the ureter, prolapse of the ureter, ballooning of the ureteric orifice, intravesical ballooning of the lower end of the ureter, ureterocele, and vesical ureterocele. Some of these, such as prolapse of the ureter and cystocele are obviously wrongly applied, as the condition is sharply distinguished from a true prolapse, and cystocele is reserved for an entirely different and distinct condition. The terms cystic dilatation, ballooning, intravesical ballooning, of the lower end of the ureter, are very descriptive of one type of the condition, but are not so appropriate for such cases as those reported by Blumer, our own and others. The term ureterocele (Gr. *ουρήτηρ* = ureter, *κηλη* = tumor) is selected as being simpler and more generally applicable to all types of this condition, and with the addition of the qualifying adjective, vesical, should be free from any serious objections.

HISTORICAL

The first observation of the condition was at a postmortem, reported by Lechler, in 1835, under a mistaken impression that

a double bladder was present. Most of the earlier observations were made at postmortems. The majority were in young females, in whom the ureterocele was evident at the vulva, and showed gangrenous complications. An excellent review, mainly of continental literature, has been made by Papin in the Encyclopaedie d'Urologie (Pousson and Desnos, Paris, 1914, vol. iii, pp. 954 et seq.), to which the reader is referred. Numerous reports have been made by observers on this continent, among them, Caillé, Blumer, Kelly, H. H. Young, Buerger, Caulk, G. J. Thomas, Lavandera, Harnagel, Barringer, Furniss and Eisendrath. The earliest operative interference was by Streubel, who, in 1858, where a tumor had presented itself at the vulva, through the urethra of a girl of fourteen, was able to place a ligature around the base of the tumor, by drawing out the tumor as far as possible. After nine days the tumor, which had a length of 8 cm., came away in a gangrenous condition. Recovery followed. The first operative interference by suprapubic excision and based on a cystoscopically controlled diagnosis, was done by Freyer in 1897. The first intervention by the transurethral route was by Fenwick in 1903. He excised a ureterocele in a female after forcible dilatation of the urethra. This is a procedure not to be recommended. Credit should be given for the first cystoscopic intervention to Kelly, who by means of his own cystoscope and fine vesical scissors successfully treated a case in 1904.

ANATOMICO-PATHOLOGICAL

From the earlier reports it would seem that the condition was found more frequently in young females. More modern reports indicate that it is found equally in both sexes and at all ages. The condition must be clearly distinguished from ureteral prolapse. In the latter, which is best seen after the expulsion of a calculus, there is an extrusion of the mucosa or of all the coats of the ureter through the ureteral meatus. The extruded cone is clothed on its vesical aspect by ureteral mucosa, whereas in the ureterocele, on the vesical side, the mucosa is exclusively vesical.

The tumor is of variable volume. At the onset, and in the

lesser degrees, there is a small, mammillated salient with a broad base, projecting into the bladder. As the condition progresses,

FIG. 1

FIG. 2

FIG. 1. EARLY STAGE OF URETEROCELE (AFTER POLLET)
FIG. 2. LATER STAGE OF DEVELOPMENT, SHOWING PROTRUSION INTO BLADDER (AFTER PAPIN)

FIG. 3. STILL LATER STAGE OF DEVELOPMENT (AFTER POLLET)

the tumor becomes more conical, and may even become pedunculated. Elongated forms may approach and engage in the

urethra, and in the female may even protrude at the vulva. In several cases gangrene of the protruded portion followed.

There are broadly two types. A cystic form, with thin transparent walls, frequently intermittent in its ballooning, its urinary contents being discharged from time to time with collapse of the sac, and a second type, in which the walls are thicker, and the tumor larger, often pedunculated, and more constant in volume.

The ureteral orifice is very variable. In some cases, the orifice is imperforate. In a case of this type, reported by Barringer, a communication had been established between the ureter and the bladder at the base of the ureterocele. The orifice may be found at its normal site, at times on the side, even on the posterior aspect. When in its normal position at the tip, it is often small, and strictured, though it may be of normal dimensions. The contents of the ureterocele may be clear or infected in various degrees. The presence of one or more calculi in the ureterocele has been frequently noted. The obstruction to ureteral drainage is responsible for dilatation and varying degrees of infection of the urinary channels above. Secondary stone formation in the ureter above the ureterocele was noted in our case, where marked dilatation and infection were present. The condition is usually unilateral, more rarely bilateral. It occurs most commonly in normally placed ureters, but occasionally the condition is found in ureters opening in abnormal situations in the bladder. Its association with other congenital anomalies, particularly double ureters, has been noted in about 50 per cent of the cases.

The ureterocele is clothed on its vesical aspect by vesical mucosa, and on the inside by ureteral mucosa with connective tissue between. Some observers have noted the presence of muscular tissue between the layers of mucosa.

THE MODE OF PRODUCTION

The discussion of this must be largely academic. Of the various theories which have been propounded to explain the condition, that which ascribes it to a congenital and develop-

mental malformation seems to be the most plausible, and most generally accepted. This is supported by the congenital stenosis of the ureteral meatus present in most of the cases. Marmier found that in only four of forty-two cases was a stenosis of the orifice absent. Moreover there are in nearly half of the reported cases other ureteral anomalies. In one case the presence of a valve was observed, obstructing the orifice. Papin who discusses the question at length is of the opinion that the condition is only the lower segment of a hydro-ureter, for whose production is required stenosis of the ureteral meatus. He is firmly convinced that the condition cannot be acquired. The contrary is stoutly maintained by others. The cases of Grosglik, Freyer, Klose and Hartmann seem to favor the probability of an acquired etiology. The explanation of a case like our own and others, where the ureteric orifice was of normal dimensions, offers considerable difficulty. There is much in favor of the assumption that the calculus impacted in the tip of the ureterocele in our case had produced the condition by progressive ballooning and downward displacement of the segment of the ureter immediately distal to the vesical musculature. Between the vesical musculature and the vesical mucosa, there is a segment of ureter, 1 cm. in length, relatively loose, and covered only with its own musculature. In our opinion, the essential factor in the production of ureterocele is a stenosis, congenital or acquired, of the vesical orifice of the ureter, or an intraluminal obstruction acting at the same point.

SYMPTOMATOLOGY

The condition may remain latent for a considerable period, and if not followed by infection may only be discovered by chance or at autopsy. Fully two-thirds of the reported cases are postmortem observations. In other cases attention is aroused by vague renal symptoms, particularly those of pain, and dependent upon the distention of the upper urinary tract. Where infection has occurred, the presence of pyuria, with varying symptoms of upper and lower urinary tract infection, will call for

investigation. In another case the presence of the tumor in the bladder will cause vague vesical symptoms of discomfort. The engagement of the ureterocele in the urethra, will suggest stone, by interruption of the stream, and may even cause a retention of urine, particularly in females, where there may be an actual procidentia of the ureterocele at the vulva. The formation of calculi is a common occurrence. By increasing the ureteral obstruction they may still further favor the production, extension and maintenance of the infection.

DIAGNOSIS

This is ordinarily only possible by the use of the cystoscope, or by surgical exploration of the bladder.

TREATMENT

There is no doubt that the condition calls for operative treatment, if it is sufficiently developed to produce mechanical or infective lesions. The treatment is twofold: (1) by the natural passages, mainly transurethral, and (2) by a suprapubic or vaginal operation.

1. The first method should be reserved for milder degrees of the condition. Under cystoscopic observation, the ureterocele has been attacked by various methods. Kelly used ureteral scissors, slitting up the cyst wall from the ureteral meatus. Caulk has employed the same method; Wulff employed a cautery; Young, his cystoscopic rongeur; Buerger, a combination of knife and punch forceps; Blum, fulguration. Harnagel has operated upon two female cases by grasping the tumor with Young's cystoscopic rongeur, and withdrawing the forceps with the attached tumor to the vulva. In one case the apex of the cyst was excised with scissors, and the base allowed to retract into the bladder. In his second case, which was not properly a ureterocele, but a stone impacted in the intravesical ureter, the ureter was similarly drawn to the vulva, and the stone released by incision on it. Cases have been reported where incision or slitting failed to produce a cure. According to Keyes

this method is not entirely free from danger. He states that the "cystoscopic scissors should not be used, as the cut may bleed so freely as to require suprapubic drainage to empty the bladder of clots." According to Legueu, however, only one case of hemorrhage after a cystoscopic intervention, has been noted, in the case of Wulff, in which a slight bleeding occurred three weeks after a cauterization.

2. For more fully developed and pedunculated cases, an intravesical operation appears to be preferable. Most advantageous is the suprapubic approach, which is the method most generally employed, when it is inadvisable or impossible to effect a cure by the trans-urethral route. The bladder being widely opened, the ureterocele is resected near its base, and the two layers of mucosa, ureteral and vesical, are sutured by interrupted sutures of fine catgut. Gayet advises the preliminary hemisection of the tumor. In a septic field, temporary drainage of the bladder is advisable. H. H. Young in one case, where a double ureter was present, with ballooning of the lower end of one, performed an ingenious plastic operation with satisfactory results. The ureterocele has been approached in the female by the vagino-vesical route. This has been done successfully by Hunner and Simon.

The important consideration in the treatment is the prevention of ureteral and pelvic stasis. The choice of method will depend upon the degree of success with which this may be achieved.

CASE REPORT

O. C., French-Canadian laborer, aged thirty-one, admitted to the Montreal General Hospital (5058-1924), October 23, 1924.

Complaints. Passing blood, pain in the right side and pain over bladder.

Present illness. The patient had been perfectly well till eight years previous to admission, when he noticed a right sided pain. This was sudden in onset, severe, and lasted for two weeks. The urine was red. He had an increased frequency of urination, both diurnal and nocturnal, with some difficulty of urination and some urgency. The condition was severe for two weeks, when it abated somewhat, and he was able to

return to work. There continued to be felt some pain in the right side, and frequency and some hematuria. Recently the hematuria has been more noticeable. He has had constant suprapubic discomfort. Four years ago he noticed pain in the rectum, aggravated by defecation. During the years since the first symptoms were noticed, he has had three attacks similar to that of onset, which forced him to take to his bed. On cross examination after the operation, he admitted having noticed that occasionally his urinary stream was interrupted. Personal and family history irrelevant.

Present condition. A well-developed male, afebrile, with slight tenderness in the right costo-muscular angle and suprapubic region. Kidneys are not palpable. The prostate and right epididymis are slightly enlarged. Urinalysis: 1014, acid, turbid, faint traces of albumin, no sugar, pus cells, 10 to 20 per high power field, red blood cells 10 to 15 per high power field. Motile bacilli. Wassermann negative. Blood urea nitrogen—25 mgm. per 100 cc. Urea concentration factor—30. X-rays reveal two oval shadows, almond sized, one in the center, the other to the right of the pelvis, opposite the ischial spine.

Cystoscopy. The first examination was not informatory owing to the bladder irritability and inflammation. A second, performed on November 4, 1926, after preliminary daily bladder lavages, revealed a finger-like mass, arising from the right of the trigone, and covered with vesical mucosa, it and the bladder being generally inflamed. To the outer side of the mass, two saccules were observed. Neither ureteric orifice could be located. No calculus was present.

Cystogram. Showed a normal apperance with a few sacculations.

Diagnosis. A tentative diagnosis of ureterocele of the right ureter was made.

Operation. November 7, 1924. General anesthesia. Suprapubic cystotomy. The condition found is best explained by the picture made at the operation. The mass which was the size of one's thumb arose from the site of the right ureter. Its extremity was bulbous and a stone could be palpated in the bulbous tip. The surface of the tumor resembled bladder, and at its tip it was dotted with stubby papillomatous excrescences. On close examination the ureter was discovered on the tip of the mass, and a ureteral catheter was readily passed, through its meatus up past the stone, and turbid urine drawn off. The bladder wall was slightly thickened, its surface inflamed with several shallow saccules. The mass was slit up from the meatus disclosing a dilated ureter, from which turbid urine escaped. The mass was then sectioned

about 1 cm. from its base, and the two layers of mucosa were sutured with five interrupted sutures of fine catgut. Several bleeding points required ligatures. The ureteral catheter was left in the ureter, and brought out through the urethra. The bladder was drained by a large

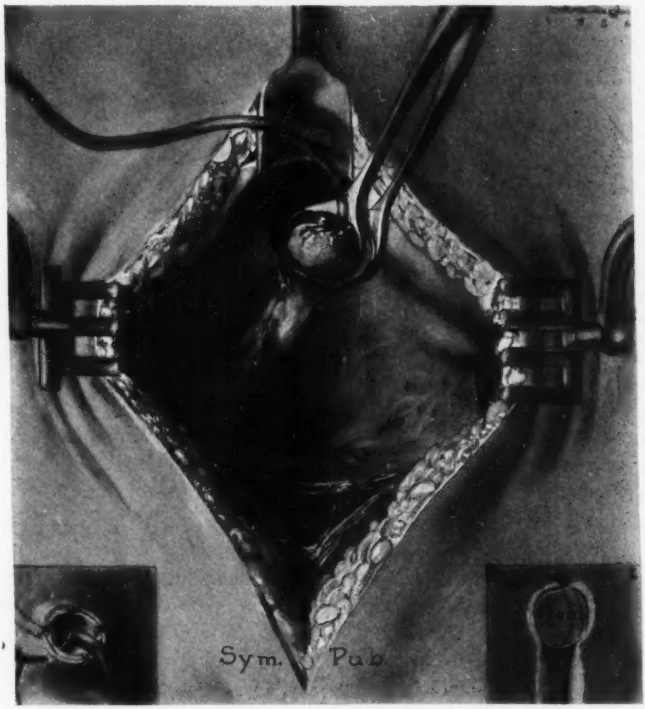


FIG. 4. PICTURE OF URETEROCELE OF RIGHT URETER, MADE AT OPERATION

1. Showing method of resection and suture.
2. Longitudinal section of ureterocele (schematic), showing calculus and ureteral catheter in dilated ureter.

bladder tube and the prevesical space by a cigarette drain. The skin was closed with silkworm gut sutures. November 11, 1924, an attempt was made to secure a ureterogram, but the catheter and fluid were obstructed at the site of the oval shadow opposite the right ischial spine. December 11, 1924, the stone was removed from the right pelvic ureter

by an extra-peritoneal uretero-lithotomy. On opening the ureter its wall was found thickened and its lumen the size of one's thumb. Convalescence was slow and complicated by a wound infection. The bladder fistula closed without incident. A cystoscopy on January 10, 1925, showed the right ureter to be still widely dilated. The urine from this kidney was markedly improved, being clear with only a few pus cells. The patient was discharged on February 11, 1925, in good health, cured.

Pathological report. (M. G. H. S-24-1105.) By Dr. Lawrence J. Rhea. "The specimen was obtained at the operation and taken to the Pathologial Laboratory at once, where the description given below was made and the specimen mounted.

"Before the specimen was mounted, the mucous membrane of the bladder, and the ureter were stitched together along the line of excision in order to prevent their separation during the process of fixation. A glass tube of the same size as the dilated lumen of the ureter was passed into the distal orifice of the specimen, and inserted until it met with a stone in the tip of the specimen. A heavy wax cord was then passed into the ureteral orifice along the surface of the stone, into and through the glass tubing which had been inserted into the dilated portion of the ureter. After sections had been removed for microscopic examination, the specimen was mounted on a glass frame for permanent preservation.

"The specimen is a piece of tissue 5.5 cm. in length; an almost completely collapsed right ureter. There is an orifice at each extremity. The orifice at the proximal extremity, the opening of the ureter into the bladder, is 3 mm. in diameter. The mucous membrane about it is thrown into irregular thin folds, giving this extremity of the specimen a papillomatous appearance. The distal 2.3 cm. is roughly ovoid in shape, as the result of a stone in this portion of the dilated ureter. The remainder of the specimen is collapsed. When restored to its natural size and shape the specimen is tubular. The orifice at the distal extremity, the line of excision, is round, and measures 1.5 in diameter. The external surface of the specimen over the stone is intact, smooth, moist and pale red. The remainder of the external surface is likewise intact, has a fine granular appearance and is pale red. Within the lumen of the ureter near the ureteral orifice, there is an ovoid shaped, hard stone, 2.5 by 2 cm. in circumference. This stone impinges upon, but does not extrude from the ureteral orifice. The external surface of the stone is slightly roughened. A probe can be passed with ease along the surface of the stone, and into the dilated ureter. The wall of

the specimen is very thin, averaging but a few millimeters. Its internal surface is smooth and pale red.

"The following microscopical description is based upon sections taken from several locations in the specimen.

"The sections include the entire thickness of the wall of the ureter. Histologically they show a ureter covered on its external surface by bladder mucosa. There are muscular fibers present, which are greatly thinned out, and run in a longitudinal direction. There is considerable chronic inflammatory reaction, most marked beneath the covering epithelium. This is especially pronounced in the sections opposite the stone. The epithelium is somewhat thickened as the result of continued irritation; this thickening is most marked in the sections opposite the stone. The character of the inflammatory reaction is of a non-specific type.

"Diagnosis: Gross specimen; ureterocele of the right ureter; ureteral calculus right; dilatation of the ureter—right; chronic inflammation."

REFERENCES

BARRINGER: Interstate Med. Jour., 1913, xx, 343. Trans. Amer. Assoc. G. U. Surgeons, 1914, 44.

BLUM: Archiv. f. klin. Chir., 1919, cxiii, 131.

BLUMER: Johns Hopkins Hosp. Bull., 1896, vii, 174.

BUERGER: Med. Record, 1913, lxxxiii, 589.

CAILLÉ: Amer. Jour. Med. Sci., 1888, xcv, 481.

CAULK: Jour. Amer. Med. Assoc., 1913, lxi, 1685.

EISENDRATH: Surg. Gynecol. and Obstet., 1911, xii, 533.

FENWICK: Ureteric Meatoscopy. J. & A. Churchill, London, 1903, 38.

FREYER: Trans. Royal Med. and Chir. Soc., November 9, 1897.

FURNISS: Jour. Amer. Med. Assoc., 1912, lix, 2051.

GAYET: Quoted in Papin.

CROSGLIK: Monatsberichte f. Urologie, 1901, vi, 577.

HARNAGEL: Jour. Urol., 1923, x, 141.

HARTMANN: Zeit. f. gynäk. Urol., 1910, ii, 21.

HUNNER: Quoted in Lavandera.

KELLY: Johns Hopkins Hosp. Bull., 1906, xvii, 173.

KEYES: Urology, 1923, 501.

KLOSE: Archiv. f. klin. Chir., 1906, lxxx, 209.

LAVANDERA: Surg., Gynecol. and Obstet., 1921, xxxii, 139.

LECHLER: Quoted in Papin.

LEGUEU: Traité Chirurgical d'Urologie, Paris, 1921, 1576.

MARMIER: Quoted in Legueu.

PAPIN: Encyclopaedie d'Urologie. Pousson and Desnos, Editors, Paris, 1914, vol. iii, 954.

POLLET: Jour. d'Urol., 1921, xi, 15.
SIMON: Zent. f. Gynäk., 1905, iii, 76.
STREUBEL: Quoted in Hartmann.
THOMAS, G. J. : Minnesota Medicine, 1921, 475.
WULFF: Zeit. f. Urologie, 1909, iii, 543.
YOUNG, H. H.: Trans. Amer. Urol. Assoc., April 3, 1912.

DIVERTICULUM OF THE URETER

CASE WITH ACUTE INFLAMMATION AND SPONTANEOUS PERFORATION

A. R. STEVENS

New York City

Diverticulum or sacculation of the ureter is rare. Relatively few instances noted at necropsy have been published, and I have found but two reports of this condition encountered at operation.

Neff (1) recorded a diverticulum 13 cm. long, and 2 cm. in diameter at the point of attachment to the ureter, which was 8 cm. above the bladder. This was removed by operation, and had apparently been the cause of repeated attacks of renal colic over a period of eighteen years in a man thirty-two years old. There was ureteral and pelvic dilatation but no decrease of function (by phthalein) of the kidney, and no infection. Hale and von Geldern (2) reported a diverticulum 5 cm. long, fusiform in shape but constricted at the junction with the ureter, at a point 10 cm. above the bladder. The diverticulum was removed by operation. Just below the attachment of the diverticulum was a stricture which the authors believed was probably congenital in origin. However, it is not clear from the report whether this was noted at operation or whether the diagnosis depended entirely on their inability to pass a catheter upward beyond this point during cystoscopic examinations, both before and after operations. Their patient was a man, twenty-seven years old, who had had pain in the lower left abdomen, off and on for seven years. The corresponding kidney showed no reduced function (by phthalein), but some infection. The patient was free from pain for a nine-month period following operation. The authors of these two reports could find no other clinical observations published prior

to their publications, and but few necropsy records. I can add no proved case from the more recent literature.

The following conditions found at necropsy are of interest, Pepere (3) described a subject with four diverticula from the right ureter, and three from the left, each from three to five cm. long. These were the apparent cause of dilatation of the ureters and kidneys. Herbet (4) recorded a diverticulum 22 mm. long, 3 cm. above the bladder. Guiteras (5) observed at necropsy a

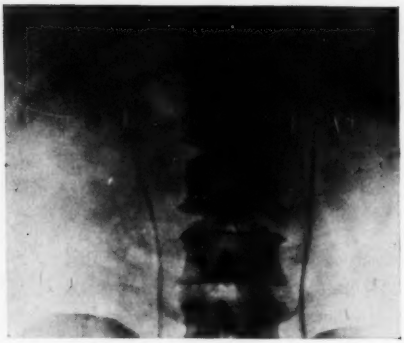


FIG. 1

FIG. 2

FIG. 1. RADIOGRAM SHOWING CALCULUS SHADOW OVER LEFT KIDNEY REGION
Right and left sides transposed in making print

FIG. 2. PYELOGRAM SHOWING DILATED LEFT RENAL PELVIS AND CALICES
Below this irregular shadow which is pyelographic media in abscess outside of urinary tract. Right and left sides transposed.

shallow cul-de-sac coming off from the intramural part of the ureter.

In 1895, Lindermann (6) claimed to have produced diverticula in young rabbits by partial ligature of the ureter near the bladder. He could not produce this in older rabbits nor in other animals. Hale and von Geldern tried to repeat the experiment in young rabbits, but failed. They obtained nothing more notable than a bud-like projection from the ureter in one of three animals operated upon.

Hunner (7) has seen one case diagnosed as probable ureteral diverticulum from radiographs taken by A. J. Crowell. Hunner operated for impassable ureteral stricture, opened the ureter above the stricture and dilated it, but unfortunately did not know at the time of Crowell's films which showed an apparent sacculation attached to the ureter just above the bladder and below the strictured area.

The origin of ureteral diverticula has been discussed by various writers. There appear to be two possibilities: (*a*) a congenital malformation— an abortive attempt of the embryo to produce a branched ureter, the additional branch failing to secure a capping of nephogenic tissue; (*b*) a local dilatation of the ureteral wall, due to increased pressure caused by ureteral obstruction below the dilatation. In the latter group, one would consider both congenital and acquired strictures. In spite of the large amount of work done in recent years on acquired stricture of the ureter, I know of no report of a condition resembling diverticulum having been found in these cases. Unless indeed one would like to put my case in this category, as there is dilatation of the pelvis and very slight dilatation of the ureter; the bulb test was not tried. That congenital stricture may sometimes be an etiological factor seems more plausible, but the evidence is not convincing. Inasmuch as embryological studies of the development of the ureters offer such a reasonable and satisfactory explanation of the etiology of ureteral diverticulum, I feel this to be the true explanation of most instances of this anomoly.

The cases referred to above were of abnormalities in the lower part of the ureter. The one here reported, presented two small sacculations at about the uretero-pelvic junction, one of which had ruptured. This would likely have been passed over as a perforated ulceration, had the second non-perforated sacculation not been discovered, less than a centimeter from the other. These were studied histologically and proved to be lined by epithelium similar to that of the ureter, and to be the seat of an acute inflammatory process such as was present elsewhere in the ureteral and pelvic walls, as well as in the kidney.

FIG. 3. URETEROGRAM SHOWING SLIGHTLY DILATED LEFT URETER

CASE REPORT

An Italian, aged fifty-nine, male, was admitted to a surgical ward at Bellevue Hospital, on February 24, 1926, complaining of chills and fever, and pain in the left lower abdomen. The family history seemed irrelevant. The patient had had what he called "gastric fever," in Africa, in 1911; pneumonia in 1914; gonorrhea about forty years ago; periurethral abscess ten years ago with perineal fistula for one year following; he denied genital sore and other luetic manifestations. He was apparently in excellent health just prior to the present illness. He could recall no sore throat, no boils or other skin infections, preceding or during the present illness.

Present illness. After exposure to cold while shoveling snow six weeks ago, the patient suddenly developed chills and fever. The illness continued two weeks, but with no pain in any part of the body after the onset. During the next week, he felt well. Then pain developed in the lower left abdomen and groin; this continued to the day of admission to the hospital, confining patient to bed. No pain was noted in the loin at any time. There was no urinary frequency nor difficulty, and no hematuria.

Examination. On admission, the general condition was good; temperature 101°, pulse 100; condition of teeth fair; no evident infection of pharynx or tonsils; no infection of the skin; lungs normal; heart normal except for soft systolic murmur at apex. The right half of abdomen was normal; a palpable mass was present along the sigmoid; tenderness was noted in left costo-vertebral angle, but kidney not felt because of muscle spasm. Proctoscopic examination revealed nothing abnormal. The urine contained much pus. The leucocyte count was 18,700, with 89 per cent of polymorphonuclear neutrophiles on differential count.

Cystoscopic examination. (March 2.) Revealed some edema about vesical neck, no evidence of prostatic obstruction, prominent ureteral ridges with plainly visible ureteral orifices, and general inflammation of the trigone more marked on left side. Catheters were easily introduced up both ureters, and brought intermittent drops of clear urine from the right side with good concentration of indigo carmine (given intravenously) in five minutes; and from the left ureter, there was a steady dropping of a milky fluid until 60 cc. had been collected—40 cc. more was obtained by aspiration, but no indigo carmine appeared in 15 minutes. The right ureteral urine contained no pus or bacteria on stained slide, and 1.8 per cent urea; while the left ureteral urine contained

much pus, no tubercle bacilli or other bacteria, and but 0.2 per cent urea.

FIG. 4. PHOTOGRAPH OF KIDNEY SHOWING MULTIPLE CORTICAL ABSCESSES

Simple radiogram of the whole urinary tract was made followed by left pyelogram and ureterogram. The lower poles of both kidneys were at the level of the transverse process of the third lumbar vertebra.

The lower pole of the left kidney was apparently pushed outward by a mass with honey-comb appearance. A shadow resembling a small calculus, 5 mm. in diameter, lay over the upper part of the kidney in the plain film, and was obscured by the sodium iodide in an upper calyx in the pyelogram. The pyelogram showed dilatation of the pelvis and

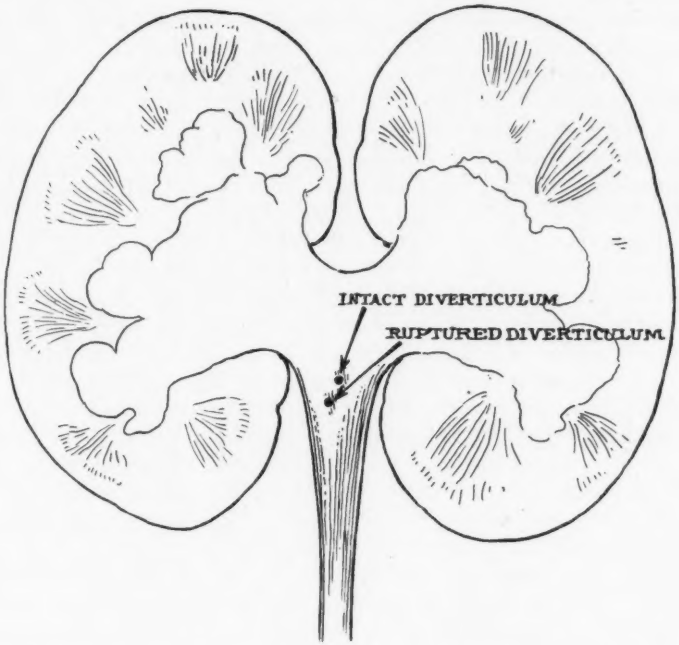


FIG. 5. DIAGRAMMATIC SKETCH OF KIDNEY SPLIT OPEN, SHOWING POSITION OF DIVERTICULA

calices, and at the uretero-pelvic junction there was an irregular shadow about 8 by 5 cm. in area, with rough outline. Below this the ureter was slightly dilated.

The patient was transferred to the Urological Service. On March 4, the writer noted that the "abdomen is symmetrical. No tenderness nor rigidity present. Right kidney not felt. In the left upper quadrant, a deep mass can be palpated bimanually. Below this, an elongated

mass is made out which may be distended colon and sigmoid. The prostate and seminal vesicles are normal, but the rectal finger, palpating against the hand on the abdomen, can just make out a soft, elastic, non-tender mass high in the left side of the pelvis." Except on admission and following cystoscopy, the temperature did not rise above 100°. The preoperative output of phthalein was 50 per cent in two hours; the non-protein nitrogen and creatinin of the blood were normal; the blood pressure, systolic 110, diastolic 90; the Wassermann was negative.

It seemed obvious that an infected hydronephrosis was present and that a perforation had occurred at the uretero-pelvic junction. The nature of this opening was not suspected. It seemed possible that the small calculus revealed by the Roentgen ray might have ulcerated through the pelvis. There was a suspicion of neoplasm of the bowel, although nothing in the history supported this view.

Operation. (March 5th.) The usual oblique incision was made over the left kidney region. The kidney was readily exposed, but was dissected from the perineal fat with some difficulty. An abscess was encountered posterior to the renal pelvis and upper ureter. This did not extend upward, but followed the ureter downward over the sacral promontory. It was drained by extending the incision almost to the horizontal level of the anterior superior spine. The kidney was firm and contained multiple cortical abscesses. The ureter was dissected downward, but soon became fixed in dense adhesions. Considerable traction was made, and it broke off 8 cm. from the pelvis. The renal pedicle was clamped and cut, and the kidney easily removed. Drains were placed at both ends of the incision, and the middle sutured.

The kidney was opened in the usual manner, and a small calculus found well trapped in an upper calyx. The kidney cortex was of usual thickness and contained multiple cortical abscesses, scattered and also grouped in two areas as carbuncle. The pelvis and calices were dilated but presented smooth surfaces. The pelvis and ureter were slit on the side away from the rupture. Two small sacculations or diverticula were found in the upper ureter; one had ruptured, but the other was intact—a pocket about 2 mm. in depth and in diameter.

The description of the microscopic appearance of the kidney tissue was summed up by Dr. Douglas Symmers as "diffuse suppurative nephritis." He reported that the microscopic examination of the ureter about the rupture "shows the presence of a chronic productive inflammatory process, characterized in places by the formation of moderately cellular connective tissue; in other places by scar tissue, and

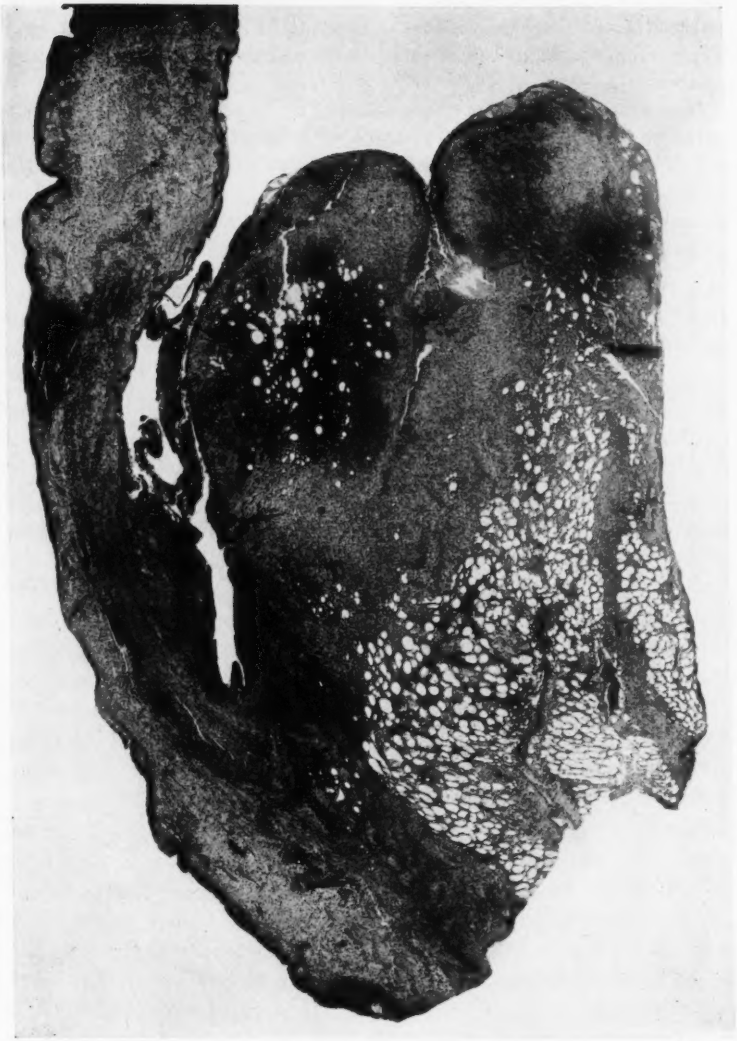


FIG. 6. PHOTOMICROGRAPH OF COLLAPSED DIVERTICULUM, SHOWING SOME EPITHELIUM LINING WALL, AND ACUTE INFLAMMATORY PROCESS

in still other places by richly vascularized granulation tissue, the latter infected, as evidenced by dense infiltration of polynuclear leucocytes." The sections through the diverticula showed the surfaces covered with epithelium.

The convalescence was uneventful. The highest postoperative temperature was 102°. The patient was afebrile after two weeks, and was out of bed on the thirteenth day. He was not discharged from the hospital until the forty-fifth day, to permit of better care of the deep granulating wounds which were healed to the skin surface when the patient went home.

REFERENCES

(1) Neff, J. H.: Southern Med. Jour., July, 1921, xiv, no. 7, 568–571.
(2) Hale, N. G., and von Geldern, C. E.: California State Jour. Med., July, 1921.
(3) Pepere, Alberti: Folia. Urol., Leipzig, 1908, iii, 396–418.
(4) Herbet: Ann. d. Mal. d. Org. Genito-Urin., 1905, 150.
(5) Guiteras, R.: Urology, 1913, 624.
(6) Lindermann, W.: Centralbl. f. Allg. Pathol. u. path. Anat., Jena, 1895, vi, no. 20, 801.
(7) Hunner, G. L.: Personal communication.
(8) Ebersbach, P. H.: Ueber ein Ureterdivertikel. Leipzig, 1902.

RESECTION OF STRICTURE OF THE SUPERIOR RENAL PELVIS FOR RELIEF OF PARTIAL HYDRONEPHROSIS

JOHN R. CAULK

Department of Urology, Washington University, St. Louis, Missouri

Localized pathological conditions in the substance of the kidney requiring correction by surgery are almost invariably dealt with by the complete removal of the organ. In the earlier days of renal surgery partial resection of the kidney was frequently practiced. Czerny in 1887 was the first, as far as I can determine, to perform a resection of a kidney; this he did for tumor. A little later Kummel resected the lower part of the organ for echinococcus infection. Küster reviewed literature and collected 30 cases of partial resection. Tuberculosis and tumor stand preëminent, hydronephrosis and stone win honorable mention. The results of such surgery were evidently not satisfactory for the majority of these conditions, and nephrectomy became the operation of choice for their correction. The operative mortality of partial removal was strikingly low in comparison to that of complete removal of the organ, the former being 16 per cent, the latter as high as 30 per cent. In recent years surgeons have reserved partial renal resections to a selected group of cases and have relegated such conditions as tuberculosis and tumor to the realm of complete excision, and only localized pathological processes which from their nature demonstrate a tendency to remain stationary and not to progress either locally or generally, have been dealt with by such conservative methods.

The trend of modern renal surgery is toward conservatism and I feel that it may be stated without fear of contradiction that in practically every surgical kidney disease, aside from tuberculosis and tumor, urological surgeons have gradually accepted a more and more conservative attitude, and, as a result, have saved

many kidneys which would have been removed. A number of recent articles on the subject of partial resection have recently appeared, and an outline of the progress of this feature of renal surgery will be eliminated from this discussion. Judd, Young, Eisendrath, König and Peters, and Lower and Belcher, have given very accurate descriptions and literary surveys of this subject and have justified the proposal of Tuffier of thirty-five years ago that, under certain conditions, resection is advisable if a part of the kidney is sound and that regeneration of the remaining renal segment should occur. I have performed two hemi-nephrectomies, one in a double and one in a single kidney.

In a kidney of fair function without evidence of compensatory hypertrophy of its mate, there are instances in which conservative renal surgery has a definite indication. Hinman has shown, and most experimental investigators and clinical observers have borne him out, that if compensation has taken place in a mate, and evidences of renal atrophy have occurred in the diseased kidney there is little hope of saving such an organ; in the majority of instances it will go on to ultimate atrophy, hence partial removal would be of no avail. Partial resections have, as a rule, been performed in recent years, both in single and in double kidneys for localized pyonephroses or calculus-pyonephroses. Quite recently Lower and Belcher performed a hemi-nephrectomy for the correction of a hydro calyx resulting from renal infundibular stricture. The result of their operation was very pleasing. About the time of their report I had under observation a patient whose urological findings were almost identical to theirs, but the operation which I performed for the correction of the condition, as far as I can determine, is the first of its character on record, and it is presented to you today under the caption of "Resection of stricture of the superior renal pelvis for relief of partial hydronephrosis" (fig. 1).

The thesis which I presented to this association in 1912 and through which my membership into this organization was obtained, concerned a condition in the kidney somewhat similar to the one I am presenting today and was corrected by a type of conservative surgery of the same character as the present one,

the former being the resection of a renal pyramid which had been obstructed by an inflammation and calcareous implantation of the papilla with a resultant cystic retention; the present one deals with the resection of a dense stricture of the superior pelvis of the kidney for the relief of retention in a localized part of the kidney pelvis.

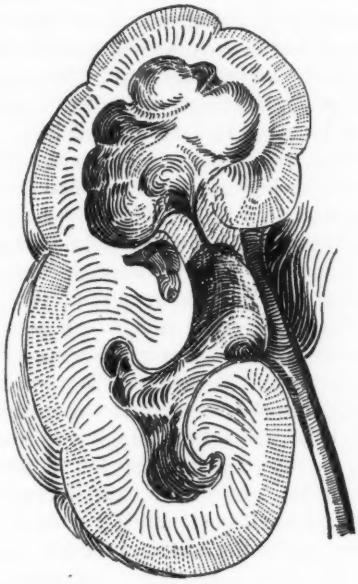


FIG. 1

The patient, a young woman in the late twenties, nurse at the Barnes Hospital, St. Louis, complained of a constant aching pain high in the back on the left side. Patient has for years suffered with frequent attacks of tonsillitis, and has been a patient in the hospital several times for respiratory conditions. In April, 1920, following a succession of renal colics on the left side, I removed a stone about the size of a grain of corn from her upper left ureter by ureterotomy. She made a quick and uneventful recovery. Following this, patient had an occasional dilatation of her ureter and lavage to protect against recurrence. She was perfectly well without renal symptoms until the fall of 1924 when

she was seized with severe renal colic on the left side which lasted about eight hours. She described this pain as being located higher in the back than her former attack and well up under the ribs; this pain did not radiate along the ureter. Catheter was passed in the ureter, no retention was found in the renal pelvis. She complained of a constant ache for almost three weeks. In the meantime repeated radiograms, plain, and with catheters in place, failed to show a definite stone, although on one picture there was a vague indistinct shadow which was quite suggestive. Immediately after the attack there were no red blood cells found in the urine nor was there infection, patient ran no fever, leucocyte count was normal, blood nitrogen and differential phthalein were perfect. Repeated pyelograms were made which showed a condition quite similar to that described by Lower and Belcher. With the catheter stopping below the uretero pelvic juncture, on several occasions it was noticed that the lower part of the pelvis would fill whereas the upper part was always indistinct, particularly in the region of the juncture of the upper and lower pelvis. On one occasion only were we able to get the catheter into the superior pelvis; pyelogram at this time showed an entirely different picture. On this occasion there was dilatation and complete filling of the upper pelvis and its calices with absolutely no flow coming back into the lower pelvis; moderate hydronephrosis was shown in the superior calyx. In other words, the constriction was so pronounced that regurgitation around the catheter was prevented. On filling this upper calyx the patient's high pain was typically reproduced. On January 7, 1925, I exposed her left kidney for the probable diagnosis of soft stone blocking the infundibulum of the upper calyx. On freeing the kidney, which looked perfectly normal, there was a definite band of adhesions around the ureter at the site of the previous ureterotomy. These were freed, and there was found no evidence of stricture of the wall of the duct. The pelvis was opened which showed no hydronephrosis; it was explored for calculus with negative findings. It was noted that the entrance from the true pelvis to the upper superior part was decidedly constricted so that it would not admit the tip of my little finger; it felt like an annular band, I could not even introduce a small stone forceps through this opening which was very fixed and rigid. A partial nephrotomy was done over this region in the upper part of the kidney, the kidney being opened down into its pelvis, the upper part of which was moderately dilated but still retained a very healthy cortical substance. On inserting a finger in this upper dilated part of the pelvis it was found that the two fingers could not be approximated though

there was no stone present, even the fluoroscope in the operating room failed to reveal a shadow. The inability to enter the upper pelvis from below, or vice versa, was due to the dense scarring at least ½ an inch in length and about as much in thickness, which resembled a keloid, surrounding the entrance to the upper pelvis. The opening through the center of this scar would scarcely admit a No. 8 catheter. On free exposure this mass of scar was thoroughly identified and by temporarily cutting off the blood supply by pedicle control, the scar tissue was resected by knife until the pelvis from below would admit my index finger and the surrounding walls seemed soft and pliable. There was very slight bleeding, one or two vessels had to be clamped and tied. It seemed evident that all of the scar had been removed and that drainage was free to the pelvis of the kidney. A rubber tube was inserted through the nephrotomy incision down into the pelvis through this resected area; the pelvic incision was closed after I had determined that a large bulb would pass easily down the ureter without signs of obstruction, and kidney closed around the tube. Patient passed through an uneventful convalescence and was soon back on duty.

Since the operation there have been several pyelograms made which show that the kidney pelvis fills; there is no retention in the pelvis, the patient has been well, and has not suffered a recurrence of contracture of this pelvis up to this time, and I trust that this operation may prove completely and permanently successful. I felt at the time that with this process so localized and apparently so easy to remove, it was certainly worth an attempt to save the upper part of this kidney which was so well preserved.

REFERENCES

JUDD: Partial resection of the kidney. Annals Surg., 1925, lxxxii, 458.
YOUNG: Surg., Gynecol. Obstet., 1924, xxxviii, 107.
PETERS: Beitr. sur Klinis Chir., 1923, cxxix, 716.
LOWER AND BELCHER: Jour. Urol., 1924, xii.
EISENDRATH, DANIEL AND PHIFER: Bilateral hemi-nephrectomy, bilateral double kidney. Jour. Urol., 1925, xiii.

ANOMALOUS RENAL VESSELS ASSOCIATED WITH URETERAL OBSTRUCTION AND HYDRONEPHROSIS

REPORT OF FOUR CASES

HENRY L. SANFORD

Cleveland, Ohio

Anomalies in renal blood supply, both arteries and veins, as to number, position and distribution have long been recognized. The clinical importance of accessory vessels to the lower pole of the kidney due to their association with ureteral obstruction and hydronephrosis is equally well known, as well as the surgical danger of hemorrhage during nephrectomy in case an unrecognized anomalous vessel to either pole is torn.

A question on which there has been disagreement, however, is whether the dilatation of the kidney pelvis and the group of clinical symptoms it produces are the direct result of the presence of the anomalous vessel or whether the hydronephrosis develops from some independent congenital or acquired cause, and only when the size and weight of the kidney cause it to sag over the anomalous vessel does its pressure on the ureter begin to produce its effect. A recent group of four clinical cases of accessory renal vessels has led the writer to study them as well as a series of autopsy specimens to attempt to offer an answer to this problem. A brief summary of these four cases follows.

Case 1. P. N., aged twenty-two, fireman. Patient received a blow over the right kidney region two years previous to coming under observation. For the last two months he has had repeated attacks of pain in the region of the right kidney practically incapacitating him from work. This pain was severe in character, always in the same location and did not radiate. Attacks came on rather suddenly and lasted several hours. No renal tumor was ever palpable. The urine was

always practically negative. A right pyelogram showed a moderate hydronephrosis with distinct kinking of the ureter at the uretero-pelvic junction. Without suspecting the presence of an anomalous vessel an exploratory operation was done and in freeing the lower pole of the kidney, a good sized artery was torn, the retracted end of which was found and tied off with difficulty. The ureter was dissected free, no stricture or other abnormality was found, and the kidney was fixed in a position to straighten out the ureter. Some weeks after the operation a second pyelogram was made which showed the kink in the ureter, present before operation, had disappeared. The patient made a good recovery and over a period of three years since operation has had no recurrence of the attacks of pain of which he complained. In this case it seems fair to assume that the moderate degree of hydronephrosis may well have been due to the trauma which the patient received two years previously, and that the anomalous vessel did not produce the symptoms of obstruction until the kidney sagged over it.

Case 2. J. F., aged ten, schoolboy. For over a year patient had attacks of moderately severe pain in the right kidney region, at times severe enough to cause vomiting. During these attacks various physicians who saw him agreed that what seemed to be a greatly enlarged left kidney could be distinctly felt. The writer never saw the patient during an attack, and two pyelograms of the left kidney made at three months interval showed a somewhat dilated pelvis with good drainage and a normal ureter. Owing to the persistence of these attacks of pain, an exploratory operation was decided on. At the lower end of the kidney a large vein, but no artery, was found crossing in front of the ureter. It did not seem at that time that this vein could be compressing the ureter sufficiently to produce intermittent obstruction. What seemed a more likely cause was a fibrous band crossing in front of the ureter very close to the anomalous vein, which was freed. Nothing further abnormal was found, the kidney was suspended and the wound closed. Since that time the boy has had no further attacks of pain over a period of several months. Before the operation, attacks occurred every three or four weeks.

As stated above, this patient was observed by several careful examiners, all of whom palpated a distinct left renal tumor during attacks of pain. The fact that a practically normal pyelogram was twice secured between these attacks speaks for the wonderful reparative and contractile power of a child's renal pelvis. In our opinion the fibrous band

and not the rather large vein must be assigned as the cause for the attacks of intermittent obstruction. It is possible that this fibrous band represents an atrophied artery which previously accompanied the

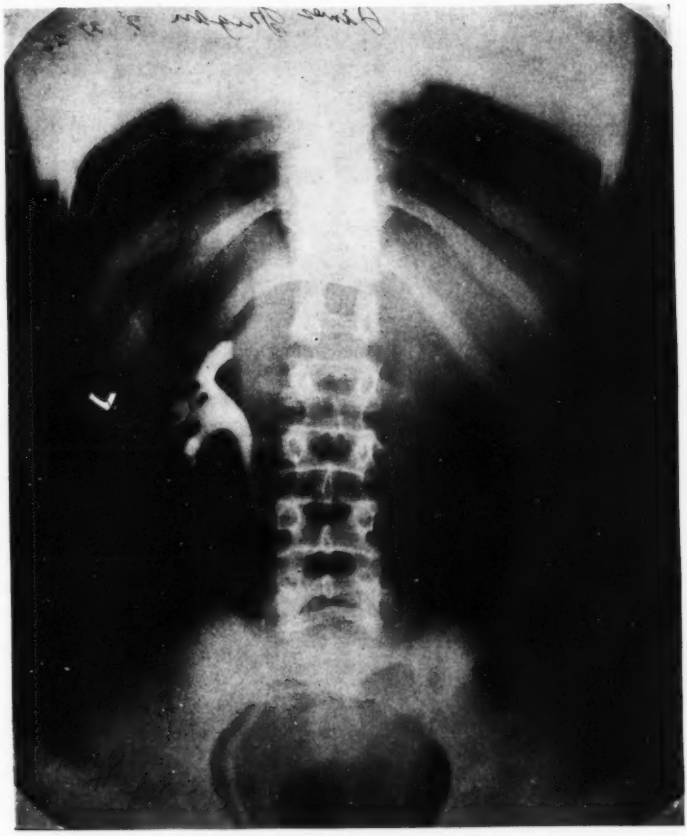


FIG. 1. CASE 2. J. F. INTERMITTENT HYDRONEPHROSIS
Pyelogram taken between attacks

anomalous vein. Further time will be necessary to prove whether the removal of the fibrous band and vein will produce a permanent cure.

Case 3. F. S., schoolgirl. For the last three years this patient has suffered from acute attacks of pain in the right lumbar region which at first recurred at longer intervals, but which lately have been coming every three or four weeks, and have prevented her from attending school.

FIG. 2. CASE 3. F. S. INTERMITTENT HYDRONEPHROSIS

Incomplete pyelogram right side. The sodium iodide was blocked at the uretero-pelvic junction and has flowed back into the bladder.

This pain came on quite suddenly, was very acute, lasted some hours, and often required morphine. These attacks had no relation to diet or exercise, and might come on in the day time or wake the patient from her sleep at night. Nausea and vomiting occurred frequently and

sometimes relieved the pain. Recently the patient found that by practically standing on her head in bed she could sometimes stop the attacks. The urine has always been negative, never any hematuria. A definite tumor in the region of the right kidney could often be pal-

FIG. 3. CASE 3. F. S. INTERMITTENT HYDRONEPHROSIS

Kidney specimen shows the stumps of the anomalous vein and artery and the greatly dilated pelvis.

pated. Two pyelograms of the right kidney were attempted at different times and both were incomplete, as the medium was blocked at the uretero-pelvic junction and no outline of the kidney pelvis was obtained.

An anomalous vessel was definitely suspected in this case, and consent

was finally secured for an exploration. At operation an artery and vein each the size of a goosequill were found crossing in front of the ureter to the posterior aspect of the lower pole of the kidney. The artery passed directly to the aorta and was not a branch of the renal artery.

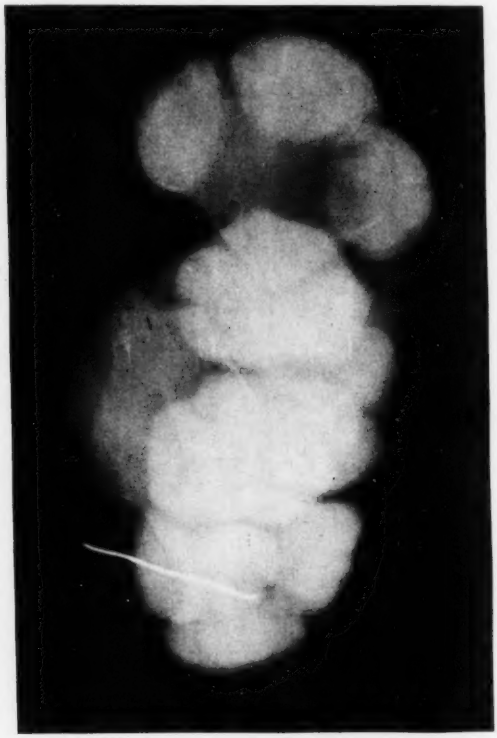


FIG. 4. CASE 3. F. S. INTERMITTENT HYDRONEPHROSIS

A pyelogram made on the kidney specimen. The pelvis and calyces held 210 cc. A wire was placed in the course of the anomalous artery.

The kidney itself was converted into a thin-walled hydronephrotic sac, and as the function of the left side was normal, nephrectomy was done. The patient made a good recovery and has had no further attacks of pain during the nine months since operation.

The anomalous artery and vein passing across in front of the ureter to the posterior aspect of the lower pole of the kidney seem in themselves an adequate cause for producing the clinical symptoms of intermittent obstruction and the gradual destruction of the kidney.

Case 4. J. C., aged thirty-five, laborer. This patient for years complained of attacks of severe pain in the region of the right kidney.

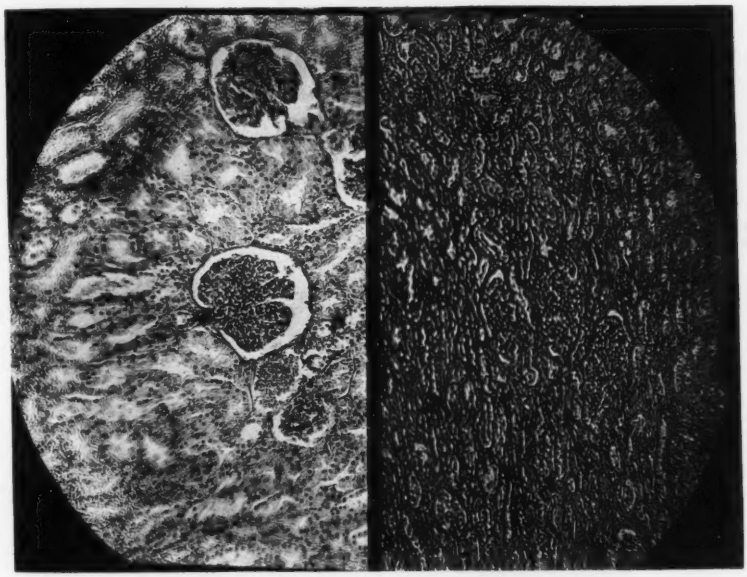


FIG. 5. CASE 3. F. S. INTERMITTENT HYDRONEPHROSIS

Comparison of section of cortex of hydronephrotic kidney with section from normal kidney from patient of approximately the same age, to show the compression of the kidney cortex caused by hydronephrosis.

The pain was located in the lumbar region, sometimes extending around to the front but never referred to the groin or testis. These attacks lasted usually for six or eight hours and were seldom accompanied by nausea or vomiting. Between attacks the patient felt perfectly well and was able to work. No renal tumor was ever palpable. The urine has always been negative except for a few pus cells. The first pyelogram

of the right side was incomplete, as the sodium iodide passed up the ureter to the ureteropelvic junction and then flowed back into the bladder. A second right pyelogram under increased pressure secured an outline of the kidney pelvis which showed a moderate degree of

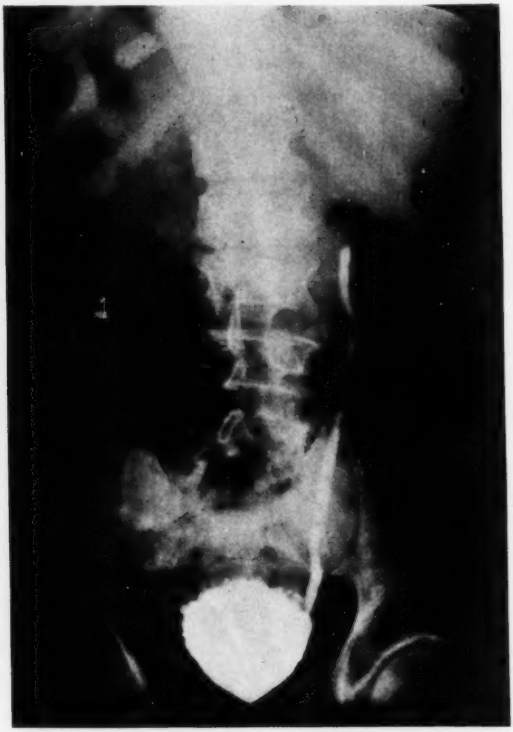


FIG. 6. CASE 4. J. C.
Incomplete pyelogram

hydronephrosis and a very definite kink in the ureter at the ureteropelvic junction. A definite diagnosis of an anomalous renal vessel was made in this case, but thus far the patient has refused operation and the diagnosis cannot be proven.

The type of pyelogram secured in this case seems to the writer almost

pathognomonic of an anomalous vessel. The spurs or valve formations, formed by the kinking of the ureter at the ureteropelvic junction are more likely to be due to an accessory vessel or a band of connective tissue from an atrophied vessel than to any other cause.

FIG. 7. CASE 4. J. C.

Second pyelogram under increased pressure shows filling of kidney pelvis and kink at uretero-pelvic junction.

ETIOLOGY

Embryology. From an embryological standpoint the reasons for anomalies of renal blood supply have been clearly explained by Bremer, from whom we quote:

1. The anomalies of the renal artery depend on vessels present in the embryo before the aorta and its larger branches develop their mesodermal coats. There are no "late branches."

2. Certain anomalies are due to the persistence of the early renal blood supply seen most frequently with pelvic kidneys, i.e., the renal artery as a branch of the iliac, inferior mesenteric, or middle sacral arteries, or from the aorta below the inferior mesenteric. The kidney is probably never without arterial blood.

3. A peri-aortic plexus with many roots from the aorta affords an opportunity for the change of position of main aortic branches and for supplying smaller branches for possible further use.

4. The renal artery is derived from this plexus or from such parts of it as exist just before the kidney receives its capsule.

5. The channel for the renal artery is selected mechanically and differs in various animals. . . . .

6. Channels not so convenient may be utilized if the usual channel is occluded; hence the variations and anomalies.

Sources. As is evident from the possibilities of variation outlined above, accessory arteries to the kidney may arise from the aorta itself or from any of its branches from the level of the suprarenal artery down to the iliac or its branches.

Frequency. Averaging statistics of various writers, some form of anomaly of renal blood supply exists in one person out of five. The anomalous condition may be bilateral, but is much more frequently unilateral. Accessory arteries are much more common than accessory veins; often a vein accompanies an artery, but a vein alone is rare. Accessory vessels to the upper pole of the kidney are more often found than those to the lower pole in the proportion of four to three.

Age and sex. Anomalous renal vessels begin to produce symptoms in the majority of cases in young people between the ages of ten and twenty-five. Males are more often affected than females and the right side is involved more frequently than the left.

SYMPTOMS

The early typical subjective symptom in these cases is the recurrence of periodic attacks of renal colic coming on out of a

clear sky in a young person, with intervals of weeks, months, or even a year between attacks, during which time the patient may feel perfectly well. In Petrén's cases he noticed the pain developed gradually over a period of a quarter of an hour to an hour (while the renal pelvis was distending), until it became very acute at the apex of the attack accompanied often by sweating and vomiting, which at times relieved the pain. The pain is usually located in the lumbar region, but may extend around to the front of the abdomen. It rarely radiates to the

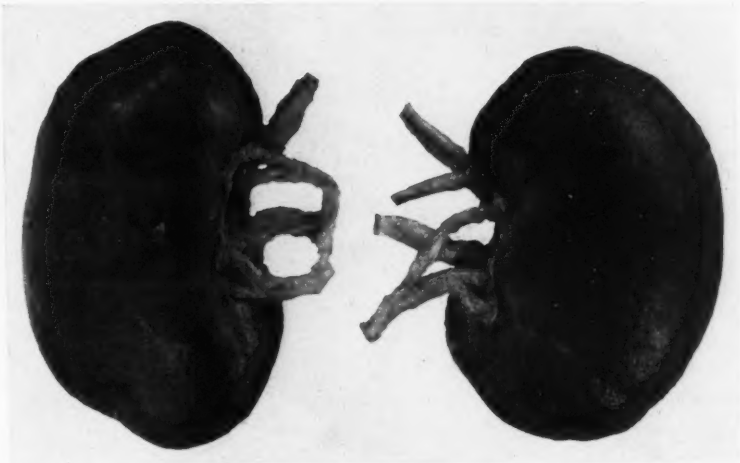


FIG. 8. AUTOPSY SPECIMEN. BILATERAL ANOMALIES OF RENAL ARTERIES
The veins have been dissected away. The stumps of the ureters show below

groin or testis and never to the shoulder. The onset of pain bears no relation to exercise or diet, may come on at any time of day or may wake the patient from his sleep at night. As in one of the writer's cases, patients who have had repeated attacks may learn to assume some position which will relieve the obstruction and pain.

Objective symptoms may be few. There is usually little temperature. A renal tumor or renal tenderness on the affected

side often is found if the patient is seen during an attack. The urine may be entirely normal. In some cases there may be a trace of albumin or a few leukocytes and red blood cells, in other instances there may be a frank hematuria. Pyelitis may supervene on a previously sterile and unrecognized hydronephrosis and give the first sign of trouble.

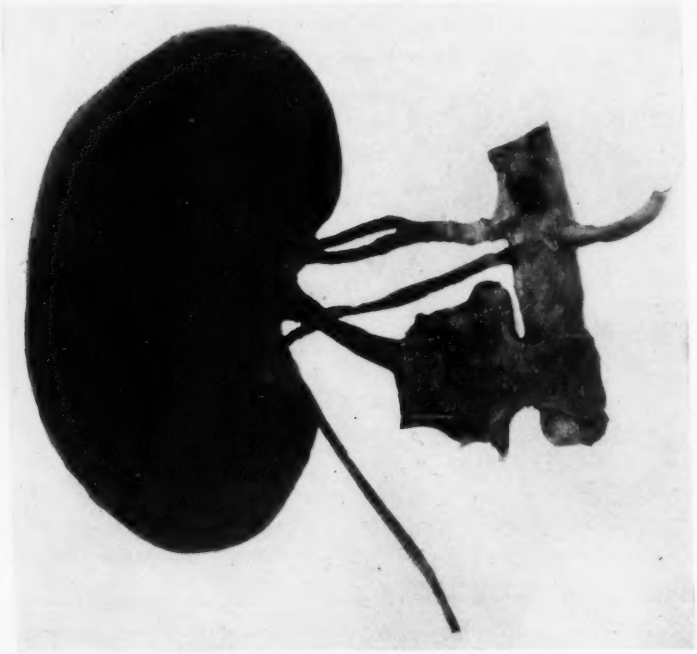


FIG. 9. AUTOPSY SPECIMEN. TYPE OF ACCESSORY RIGHT SUPERIOR POLAR ARTERY, ARISING FROM THE AORTA

DIAGNOSIS

As anomalous renal vessels occur more often on the right side, the diagnosis is frequently confused with other conditions, and numerous cases are on record which have been operated on without relief for appendicitis, duodenal ulcer and gall stones.

Early diagnosis of a beginning hydronephrosis is difficult and may be impossible unless the patient is seen in an attack, and enlargement and tenderness of the affected kidney are discovered. The lack of connection between the pain and diet should help to differentiate it from duodenal ulcer; gall stones usually occur in older people, and the lumbar location of pain, the absence of temperature, leukocytosis and abdominal rigidity should help to distinguish these attacks from appendicitis. Renal calculi, if present, should be discovered by x-ray, the pain of calculus is

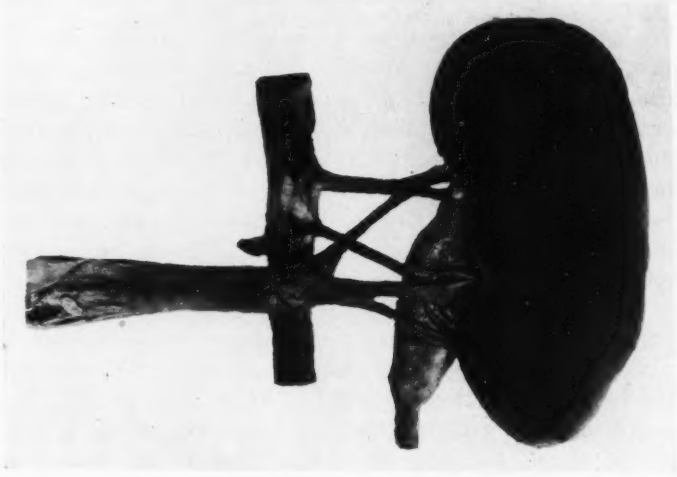


FIG. 10. AUTOPSY SPECIMEN. DOUBLE RENAL ARTERIES

often referred to the groin or testis, and there are usually dysuria and definite urinary findings.

Aside from these means of differentiation, a pyelogram of the affected side is the most satisfactory diagnostic help; if this shows a dilated pelvis and especially a kink or twist in the ureter at the uretero-pelvic junction, without evidence of calculus or other cause of pelvic obstruction, the presence of an anomalous vessel should be suspected in cases showing the group of symp-

toms described above even though the patient may have no subjective urinary symptoms and although the urine is negative on examination. Incomplete pyelograms which were found in two of the writer's cases in which no shadow of the kidney pelvis is secured and the injection medium is blocked at the uretero-pelvic junction, also strongly suggest the presence of an obstructing anomalous vessel. It is most important to make an early diagnosis in these cases before repeated attacks of intermittent obstruction have permanently damaged the kidney.

TREATMENT

With a diagnosis based on the symptom complex described above, and especially if a pyelogram has been secured showing a hydronephrosis with obstruction at the uretero-pelvic junction, an exploration of the kidney is indicated, after having determined the function of the other organ. The lower pole of the kidney is carefully dissected free and any anomalous vessels which may be found are divided between clamps and both ends tied off. If no vessels are found, search should be made for fibrous bands which may be obstructing the ureter. If present, they should be cut away and the upper ureter and pelvis completely freed. At times the distended pelvis will be seen to empty itself when the obstruction is relieved. The condition of the kidney will determine what is to be done with it. If it is converted into a thin-walled sac and especially if it is infected, it should be removed, if the other kidney has shown adequate function. If the kidney seems worth saving it should be suspended in a position to straighten out the ureter and give good pelvic drainage. When this can be done it is simpler and more effective than any plastic operation on the pelvis or ureter. In cases of large accessory arteries to the lower pole, the ligation of which would destroy the blood supply of a considerable portion of kidney substance, some surgeons have successfully reimplanted the ureter in a position in which the anomalous vessel could not obstruct it. The writer has not found it necessary to do this in any of his cases.

PROGNOSIS

The outlook for the integrity of a kidney with anomalous vessels to its lower pole depends on the amount of obstruction they produce on the ureter of that side, and the speed with which the condition is recognized and relieved. The prognosis for

FIG. 11. AUTOPSY SPECIMEN. CHILD OF FIVE YEARS. THREE DISTINCT RENAL ARTERIES AND THREE VEINS

life should be uniformly good although rare cases of bilateral unrecognized anomalous renal vessels obstructing both ureters and causing death have been reported by Hutchinson.

ARE ANOMALOUS VESSELS THE PRIMARY OR SECONDARY CAUSE OF THE CLINICAL SYMPTOMS?

It seems perfectly clear that something beside the mere presence of an anomalous vessel or vessels to the lower pole of a kidney is necessary to produce obstruction to the ureter. Accepting the statistics that one kidney in five has some anomaly in its blood supply, and that somewhat less than half these anomalies are inferior polar vessels, if the mere presence of the accessory vessel were enough in itself to produce obstruction and pelvic distension, we should find a hydronephrosis in one kidney in every twelve.

In our study at the autopsy table in subjects well beyond middle life, we have found accessory inferior polar vessels which produced no obstruction and were not associated with hydronephrosis. Some other factor must be added to cause these accessory vessels to exert pressure on the ureter, and we believe that at times they may act as a primary factor and in other cases as a secondary cause of obstruction. It seems fair to assume that inferior polar vessels may be the primary cause of ureteral obstruction under three conditions:

a. When they must necessarily press on the ureter or ureteropelvic junction; when either as a branch of the renal artery or the aorta they pass in front of the ureter to the posterior surface of the hilus or lower pole of the kidney or, vice versa, when they pass behind the ureter to enter the hilus or lower pole on its anterior aspect. Such a diagonal course of the vessel would tend either to press down on the ureter or to loop it up. This explanation was first offered by Ekehorn.

b. When conditions arise which put the anomalous vessel under tension. Liek has suggested the theory that there may be a difference in the rapidity of growth between the main vessels and the anomalous vessel, supplying as it does only a small part of the lower pole. If the latter does not develop as fast as the main vessels, it may be made taut and exert pressure on the ureter.

c. Accessory vessels may atrophy into fibrous bands which contract and cause ureteral obstruction.

It is easy to understand how accessory inferior polar vessels may be the secondary cause of ureteral obstruction following the development of a hydronephrosis from any independent source, resulting in the sagging of the kidney over the vessel.

We have thus far looked for anomalous renal vessels in fifty autopsies at the Cleveland City Hospital and found them in ten cases, a percentage which closely agrees with the averaged statistics. Of these ten cases six were upper polar vessels and four were accessory vessels to the lower pole Hydronephrosis and definite evidence of ureteral obstruction were present in two of the lower polar cases. As soon as we have had an opportunity to look for this condition in a much larger number of autopsies more detailed findings will be given in a later communication.

CONCLUSIONS

1. The mere presence of an anomalous vessel to the lower pole of a kidney is not enough in itself always to cause ureteral obstruction. This seems proven from autopsies in individuals well beyond middle life where such accessory vessels were present without evidence of ureteral obstruction or hydronephrosis.

2. In other cases it seems equally clear that the accessory lower polar vessel is the primary cause of the intermittent ureteral obstruction.

3. In a third group of cases an anomalous vessel to the lower pole of the kidney will act as a secondary factor in producing obstruction, when owing to the development of a hydronephrosis from some independent cause, the kidney sags over the vessel and the ureter is blocked.

REFERENCES

BARD: Jour. d'Urolog., 1920, ix, 243.
BRAASCH, W. F.: Jour. Amer. Med. Assoc., 1909, lii, 1384–1388.
BREMER, J. L.: Amer. Jour. Anatomy, 1915, xviii, 179.
EISENDRATH, D.: Trans. Amer. Urol. Assoc., 1920, xii, 150–172.
EKEHORN: Arch. f. Klin. Chir., 1907, lxxxii, 955.
HELM: Deutsch. Zeitschr. f. Chir., 1920, cliv, 277.
HUTCHINSON, J.: Proc. Roy. Soc. Med., 1913, vi, 201–221.
KROPEIT: Zeitschr. f. Urol., 1924, xviii, 387.
LEEK, E.: Deutsch. Zeit. f. Chir., 1920, cliv, 277–282.
PEYRÉN: Beitr. z. Klin. Chir., 1922, cxxv, 493–518.
RUPERT: Surg., Gynecol. and Obstet., 1913, xvii, 580.

DISCUSSION

Dr. HENRY G. BUGBEE (New York): I would like to show two slides in discussion of Dr. Sanford's papers, as they bring out a point which his slides did not seem to demonstrate.

(Slide) This picture is identical with two others. I have had three cases of obstruction due to anomalous vessels within the last two years, and they all presented this same picture. By using a rather pliable catheter, I was able to pass the catheter into the pelvis in each case, and with even as great distention as this, there was no reflux of the distending fluid down the ureter. That was characteristic in the three cases, and the diagnosis of ureteral obstruction due to anomalous renal vessels was made in each case, and confirmed at operation.

(Slide) This is a photograph of the kidney after the removal. The kidney confirms the pyelogram.

Dr. WILLIAM C. QUINBY: How old was that patient?

Dr. BUGBEE: This last one was forty-seven.

Dr. QUINBY: Did he have symptoms?

Dr. BUGBEE: Yes.

Dr. QUINBY: How long?

Dr. BUGBEE: For several years.

Dr. QUINBY: Twenty?

Dr. BUGBEE: No, not as long as that. The symptoms apparently came on with the onset of an infection.

Dr. ANDREW J. CROWELL (Charlotte, N. C.): Will Dr. Stevens please put the slide of Miss Harris on the screen?

If you will notice, the tip of the ureteral catheter is at the upper end of the diverticulum, showing the obstruction at the upper border of the latter. If the obstruction had been at the tip end of the catheter, the diverticulum would have been above instead of below it. The ureter is dilated from the bladder for about one inch to the end of the catheter. We had no difficulty in catheterizing this patient's ureter once or twice but failed at other times. After taking this picture we saw that the ureteral wall had given way on one side and explained why it was so difficult to catheterize the ureter. The catheter would double up in the diverticulum unless by accident entered the ureter at the upper border of the dilated ureter.

The history of this patient is quite interesting. She is a trained nurse and was in charge of a colored ward in France during the war. While nursing a delirious pneumonia case, she was attacked by this negro who cut her face fearfully. In her tussle with him, she felt a severe pain in her left inguinal region. This annoyed her more or less until operated upon by Dr. Hunner. I do not know what he did for her but I know she was greatly benefited by this operation. I have frequently thought that the ureter was ruptured in the tussle with the patient and that the dilation continued by the obstruction offered by the bladder wall to the outflow of urine and in this way caused her symptoms.

Dr. EDWARD L. KEYES (New York): Your description suggests to me the possibility that this was a diverticulum of the bladder with the ureter opening into it.

Dr. CROWELL: No, it was above the bladder wall. There was no diverticulum.

Dr. FRANCIS R. HAGNER (Washington): I just want to mention a case we have had in the past year in which there was an anomalous vessel that did not run into the kidney but into the fatty tissue around the kidney, and caused severe pain to the

patient, a boy seventeen years of age. He had recurrent attacks of vomiting and almost continuous pain in the side. On studying, we found the pelvis perfectly normal in size, but the picture of the kidney pelvis was turned antero-posteriorly. The vessel passed over the lower pole of the kidney, causing a depression in the kidney structure, I would say, of ½ inch.

We did not make a diagnosis of that before operation. We did an exploratory operation on him. But if we had studied the pictures carefully (they were excellent pictures) we could have, in following the outline of the kidney in the x-ray, seen the notching of the lower end of the kidney where this vessel went over. It was incised, and the kidney went back into perfectly normal position, and the boy has never had any symptoms since that time.

Dr. ARTHUR H. CROSBIE (Boston): I saw a case of ureterocele two or three years ago in a young man I was examining for pyuria. Cystoscopic examination showed a cystic dilatation in the region of the left ureter about the size of a hen's egg. I was unable for some time to find any opening to put a catheter into. Finally, the catheter slipped in above this cyst and passed up and on a distance. From that, I collected some perfectly normal urine.

Pyelogram made showed a small, normal pelvis in the region of the lower pole, but I felt that this did not explain the condition. I was unable after several attempts to find any opening into this large cyst, so finally, under spinal anesthesia, I opened the bladder and opened the cyst. There was a gush of turbid fluid, and I was then able to put my finger up into what appeared to be a large, dilated ureter. I then passed a catheter up, and did a pyelogram, and that showed a large hydronephrosis of the upper pole. It was a case of double ureter, the ureter that I originally got into going to the lower pole, and the lower one where there was the ureterocele going to the upper pole, at which there was a large hydronephrosis. I eventually had to remove this kidney.

Dr. GILBERT J. THOMAS (Minneapolis): I wish to report a case of bilateral ureterocele occurring in a young man in the early

twenties who complained of pain on the right side resembling ureteral colic. There was no pus in either catheterized specimen. On the right side, the ureterocele was as large as a walnut. It dilated when filled with urine and then relaxed as the urine was expelled into the bladder. On the left side, the same condition was found, except that the tumor was not quite as large.

Because of the position of the ureteral openings, catheterization was easy, which is not always the case. If the bulging is more prominent on the external lip of the ureter, the ureteral opening is turned inward and sometimes backward, making catheterization almost impossible. When this is true, the only way to relieve the condition is by opening the bladder and surgically removing the lower end of the ureter. If, however, the bulging occurs so that the ureteral opening is turned outward or forward, catheterization is comparatively easy and simple dilatation with large catheters will enlarge the ureteral opening. This has occurred in my experience two times.

In the case that I reported some years ago, it was necessary to fulgurate the lower end of both ureters so that the tumor was destroyed and the ureteral opening made large. The patient was re-examined two or three times following this manipulation, when I found the ureteral openings patent and resembled the golf hole type.

I have one woman now who has this condition in the right ureter. She comes in for examination and dilatation when necessary. The condition has not recurred following dilatation as we do not find the large size tumor that was present before dilatation was started. However, we still find difficulty in introducing the catheter through the meatus. This is an instance wherein the patient is symptom-free, from simply dilating the ureter with a large ureteral catheter.

Dr. Edward L. Keyes (New York): I would suggest the possibility that the diverticula, in Dr. Stevens' case, were due to the stone found in one of the calyces.

Dr. George R. Livermore (Memphis): I would like to say

that I agree with Dr. Sanford, in that I do not believe these cases of obstruction are due entirely to the anomalous vessel alone in all cases, because unquestionably when the ureter becomes inflamed, elongated, and flabby, it may hang over an anomalous vessel, which it otherwise would not do. The same is true in movable kidneys.

When the kidney becomes movable it drops down and pulls the ureter over the obstructive vessel, which otherwise would not have caused any trouble. Many of these cases can be relieved by fixation of the kidney, either by belt or operation and by ureteral catheterization and irrigation, or in the purely inflammatory cases simply by the retention catheter and irrigation.

Dr. WILLIAM C. QUINBY (Boston): I would like to call to the attention of the gentlemen the type of case described so nicely by Dr. Sanford. I have been very much interested in this type of case for some time, and I am not sure that he has been able to tell us, as he suggested, "which is the hen and which is the egg." It has not been brought out at this meeting anyway, that a large proportion of cases of this type of hydronephrosis is found in young adults, and the point of my question of Dr. Bugbee related to that: that in a large number of these patients, one finds that the symptoms first began in the second decade: somewhere from ten to twenty or twenty-one years of age. If the patient when seen, is older, a careful history will show that the attacks of colic, although they may have been very sparse, began when the patient was between fifteen and twenty years of age.

This suggests to me that since birth there has been continuous interference with renal motor function, or at least with the propagation of urine away from the kidney, but that since interference is very slight it only reaches a degree sufficient to make itself manifest in the way of symptoms sometime during this period of life.

I am sure there is such a group of cases. Just how one may explain the relation of the artery to such dysfunction, if you wish to call it that, I am not certain, but one can find analogies in the bowel. We know very well that peristalsis in the intestine is inhibited not only by disease, but by trauma. If you pinch the intestine, peristalsis will cease; or such trauma may set up retro-

peristalsis. In the case of an acute ileus, we know that peristalsis is inhibited by nature.

Similarly in the ureter, if you treat the ureter of an experimental animal by pinching or by chemicals such as a crystal of barium sulphate, peristalsis will cease over a considerable period of time. It is, therefore, conceivable that the relation of the vessel to the ureter in these cases may be something of this sort; by its proximity, by the fact that it carries pulsation, it may very slightly interfere with peristalsis to a degree that during the time from birth till the age of twenty years a hydronephrosis is produced.

This is pure speculation, but it appeals to me as a possible explanation of our findings in such cases of hydronephrosis

Dr. William F. Braasch (Rochester, Minn.): I would like to corroborate Dr. Quinby's observation in regard to the patient's age affecting the possibility of anomalous blood vessels being the etiologic factor of hydronephrosis.

We have gone as far as to make the diagnosis of anomalous blood vessel etiology with hydronephrosis in patients whose symptoms appear before they are twenty years of age. The following clinical picture is typical: A young girl of twenty-four years has a history of intermittent attacks of lateral abdominal pain of eight or ten years duration. Cystoscopy shows evidence of a possible hydronephrosis. The urogram will show a ureter which is normal as far as the uretero-pelvic juncture, where there is an area of demarcation and above it is a bulging pelvis.

It is very rare that a woman of over thirty or forty years has a hydronephrosis with an anomalous blood vessel etiology.

The frequency with which anomalous blood vessels will cause ureteral obstruction depends largely upon the efforts made by the surgeon to find them. Some surgeons find them much more often than others. It has been my observation that the surgeon who looks for such a vessel and takes care to make an anatomical dissection of the pedicle will find it much more frequently than the one who does not.

Dr. Edward L. Keyes (New York): On the other hand four out of five anomalous vessels are not associated with hydro-

nephrosis, I mean anomalous vessels from the lower pole, either from before or behind.

Dr. BRAASCH: Very true, but if you get an anomalous blood vessel, or atrophic bands which formerly had anomalous blood vessels, and you cut it and the pelvis empties, you might be reasonably certain that this was an etiologic factor.

Dr. EDWARD L. KEYES (New York): It fell over the clothes-line. The clothes-line was always there.

Dr. STEVENS (New York): In connection with Dr. Patch's paper, I would like to put on the record a very curious case.

A patient had been cystoscoped by me and proved to have a definite ballooning ureterocele. One year afterward, he had symptoms of ureteral calculus. I looked up my record and found that the pain was on the same side as the ureterocele. X-ray confirmed the fact that he had a ureteral calculus.

While I was debating what we should do, the patient passed the stone, indicating that the small openings in a ureterocele may dilate and permit the passage of a pretty good-sized calculus.

Dr. Keyes suggested that in our case just reported, the calculus found in one of the upper calyces might have been a distinct factor in causing the perforation in the pelvis. I do not believe this is the case because the opening between that calyx holding the stone and the pelvis was very small and the calculus could not pass.

If it did have any causal relation to these small openings in the uretero-pelvic region, we must suppose that the stone came down and made its little pockets, and then returned to the calyx and became fixed there. I do not believe that is hardly probable.

May I add one thing that Dr. Keyes asked me to speak of?

Dr. Patch mentioned the fact that Dr. Keyes had reported one instance of cutting of the ureteral orifice, in which subsequent bleeding required opening of the patient's bladder. I just mentioned to Dr. Keyes that I had had one such case. After the ureteral opening was cut by cystoscopic forceps, the patient had the bladder fill up with clots. These were removed through a large Bigelow tube. It filled up once more and I had to perform suprapubic cystotomy.

SECOND DAY, MAY 11, 1926

DIVERTICULUM OF THE FEMALE URETHRA

ARTHUR S. CROSBIE

Boston, Massachusetts

My only excuse for presenting this case is its rarity. The diagnosis was easy and the operative treatment was simple.

The patient, a woman of thirty-eight, had a hard instrumental delivery a year ago. During her pregnancy, she had a vulvo-vaginal abscess which was opened. This healed without difficulty.

Soon after her delivery, she noticed a lump in her vagina. She went to the Gynecological Department of the Boston Dispensary for examination. She was referred from there to the Urological Department, where she was seen by my assistant, Dr. Harold Chamberlain.

She had no frequency and no pain. Her only symptom was the lump in the vagina.

On examination, he found a soft, fluctuant tumor the size of a hen's egg on the anterior vaginal wall. The urine from the bladder was negative, except for a rare leukocyte. Cystoscopic examination showed a normal bladder.

It was found that when pressure was applied over the mass, it almost completely disappeared. A few drops of turbid fluid would appear at the meatus and about 2 ounces of turbid fluid could then be drawn from the bladder. This fluid contained much pus and many colon bacilli.

Endoscopic examination showed an opening in the floor of the urethra about ½ inch from the meatus that looked like the opening of a diverticulum of the bladder.

A catheter was easily introduced into the opening and with sodium iodide introduced into the pouch, a well defined diverticulum showed in the x-ray. The bladder was then filled with sodium iodide and another picture was taken showing the relation of the diverticulum to the bladder.

At operation, an incision was made through the vaginal mucous mem-

brane over the sac and the sac was then dissected free to the urethra where it was transfixed and removed.

The sac looked exactly like a diverticulum of the bladder.

The pathological report is as follows:

"Specimen consists of a funnel-shaped mass of tissue 3 cm. long, 1.5 cm. in diameter. Outer surface is dark red covered apparently by muscle. Microscopic examination shows lining made up of squamous

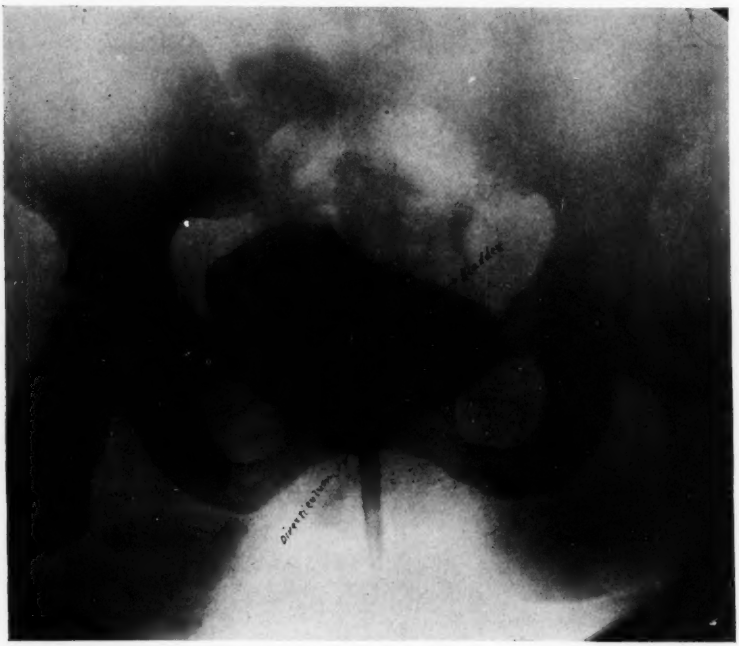


FIG. 1

epithelium. About one-third of surface is denuded and here granulation membrane is present. There is diffuse hemorrhage into tissues here with heavy polynuclear exudate. The lumen contains a small amount of fibropurulent exudate."

Diagnosis: Diverticulum of urethra.

The pathological report looks much more like diverticulum than a dilated gland sac.

DISCUSSION

Dr. GILBERT J. THOMAS (Minneapolis): Mr. President, I have had a twin to Dr. Crosbie's patient. This condition occurred in a married woman in the late twenties, who had recently gone through a very severe pregnancy which necessitated an instrumental delivery. As far as the patient knows, she was not injured during the delivery.

The history following her pregnancy was that she had some difficulty passing her urine. Her physician noted some pus in the urine. He did not report to me that the patient had any tumor presenting in the vagina. The physician attempted to cystoscope the patient and said that when the cystoscope was introduced he was unable to find the ureters. The patient was sent to me with a diagnosis of anomalous exit of the ureters into the bladder. I was directed to find the ureters if possible.

The cystoscope passed through what I thought was a very short urethra, into a cavity that seemed a little small for the bladder. As fluid was allowed to run into the cavity an enlarging tumor presented into the vagina. I was unable, after searching for fifteen or twenty minutes, to find any evidence of a ureter. I depressed the roof of the bladder, in an attempt to see if the ureters might not open into the roof, but was unable to see them.

The direct vision cystoscope was removed, and an indirect vision instrument and later a urethroscope, were used without finding ureters. Finally, on the third or fourth attempt at cystoscopy with the cavity only partially filled with water, I observed a tiny opening in the anterior surface of this cavity. Ureteral catheters were passed into the opening and the patient was given indigocarmin intravenously. The dye returned through the ureteral catheters, but much delayed in time. We made an x-ray examination with the ureteral catheter in place. The film revealed the catheters coiled in the urinary bladder. We then

injected the lower cavity with sodium iodide and allowed the catheters to remain coiled in the bladder. We were then able to make a correct diagnosis.

Unfortunately, this patient did not remain in my hands so that I had no opportunity of operating. This is the first case of this kind that I have ever seen. I have a drawing here which shows the condition just as it was when we first saw her. You will ask why the urethra is so long. That is because this tumor was a large one, ballooned out, and probably pushed the bladder up a little bit, in addition to presenting into the vagina.

Dr. Joseph Hume (New Orleans): I believe this case that Dr. Crosbie reports belongs to a fairly well known group that the gynecologists speak of as suburethral abscess. I have seen perhaps a dozen of these cases and they are very interesting, in that they complain of frequency and pain on urination, or pain in the vagina and are often obscure and difficult to interpret at first.

In examining these cases, you are very apt to slip up. Usually, if you make a palpation by the vagina, you can strike a sensitive point. Sometimes you can find a little mass no larger than a green pea. Again, I have seen some fully as large as a hen's egg. The curious thing about the small ones is that unless you press exactly right, you will not get a drop of pus to exude from the urethra. Often, the canal that leads to the abscess cavity is tortuous and irregular, and if you press in one direction you will not get anything at all and you will think that there is no discharge coming out of the urethra; yet if you press in another direction, you will get three or four drops and sometimes in the large ones I have gotten as much as a half ounce of infected, turbid urine containing pus and bacteria.

In the urethral examination, it is very difficult often to get the opening and you have to be sure to use several different types of instrument, like the Koch or Young urethroscope as well as lens instruments—the straight-on urethroscope of Gehringer is often helpful.

In the treatment, there are apparently just two plans that will give you any results: with the small ones, to enlarge the opening

with high frequency current; and with the large ones, as Dr. Crosbie suggests, to make an open section from the vaginal side. But they are very interesting and they are obscure, and you overlook them, unless you are very, very careful.

Dr. JOSEPH F. MCCARTHY (New York): It seems to me the symptomatology is a very important factor in these cases.

Some years ago a young, unmarried woman gave a history of incontinence, only while walking; no previous history of urethritis; no residual urine; no history of lues; reflexes normal.

I cystoscoped her perhaps a half dozen times, trying to find the cause of this trouble. At the last examination, on withdrawing the instrument, with the water flow going, an opening was observed on the floor of the urethra which would dilate, and on stopping the water flow, would close.

The history and the symptomatology perplexed me for some time until I had found this opening. It seems that in the act of urination, this sacculation or diverticulum would fill, and when she walked, would massage this urine out. Excision brought about complete recovery.

STUDIES IN BLADDER DECOMPRESSION

MEREDITH F. CAMPBELL

From the Urological Service of Bellevue Hospital, New York

The relative merits of rapid and slow decompression of the over-distended bladder have been studied heretofore in terms of its effect upon renal function, blood pressure, and such local conditions as haematuria and cystitis.

Thus Van Zwalenburg (1) was the first to note the advantage of slow decompression and to devise a simple method for its accomplishment. Bumpus and Foulds (2) confirmed the observations of Van Zwalenburg and concluded that decompression should be carried on for at least three to five days. O'Conor (3) noted the evil effects of rapid decompression upon the blood pressure.

None of these studied the precise changes in intravesical pressure resulting from withdrawal of small amounts of fluid from the overdistended bladder. Inasmuch as *this* is the important factor, in 1921 at Bellevue Hospital we began a series of experimental observations on the distended bladder.

Our first observations were made on a series of patients admitted to the hospital in acute retention. All were suffering with adenoma of the prostate save one, a boy in reflex retention, the result of an acutely tender pilonidal cyst. The method employed was the following:

A small clamped soft rubber catheter was inserted into the bladder. When in place it was connected with a manometer through a three-way stop-cock, the purpose of this being to permit either withdrawal of urine or reading of the bladder tension. With all connections tight, the clamp was removed and the initial bladder pressure noted. Thirty cubic centimeters (1 ounce)

were then slowly removed and pressure again noted. This was repeated until intravesical pressure was zero. The bladder was then completely emptied and the residuum recorded. The whole procedure took from twenty to forty minutes. Exception to this method was made in three instances. At a point during the evacuation we twice waited five minutes, once three minutes, and noted a transitory rise in bladder tension which

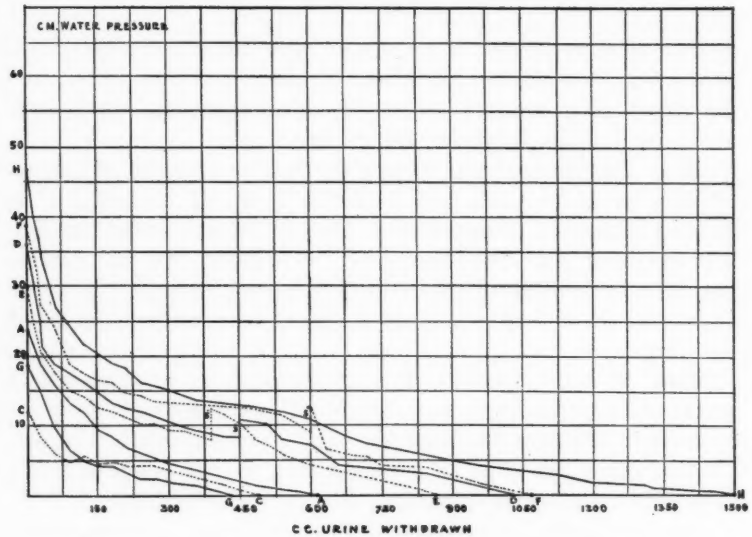


FIG. 1. EFFECT OF CATHETERIZATION ON INTRAVESICAL PRESSURE

In cases *E* and *F* a slight increase in tension is noted after waiting five minutes. In *D* the wait was for three minutes. The amount of urine left in the bladder at 0 cm. pressure is shown in figure 3.

again dropped with the removal of the next few cubic centimeters to conform with the general trend of the curve previous to the waiting period.

The results of these observations are graphically shown in figures 1 and 2. They may be summarized as follows:

In all cases the bladder tension was reduced 50 per cent by with-

drawal of 120 cc. (4 ounces). This 50 per cent pressure reduction was obtained after withdrawal of 90 cc. in three cases and after removing 60 cc. in three cases. In all cases withdrawal of 30 cc. (1 ounce) reduced the tension 25 per cent. It is to be noted, furthermore, that when the bladder pressure reached zero, residual urine remained in amounts varying from 90 cc. to

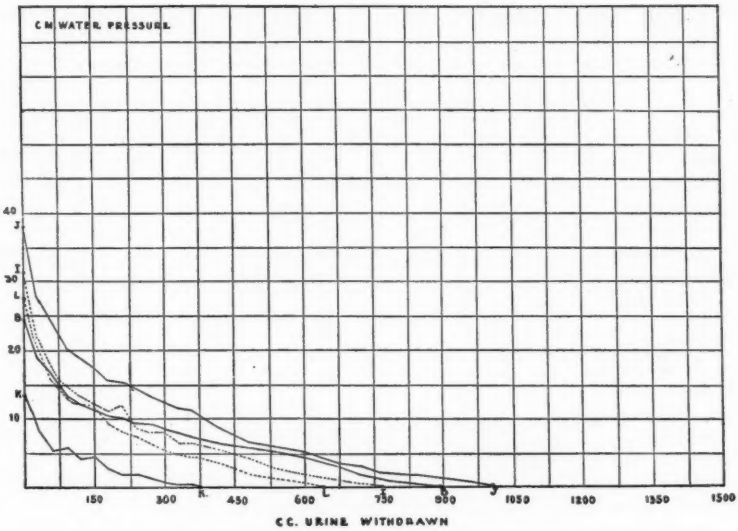


FIG. 2. EFFECT OF GRADUATED CATHETERIZATION ON INTRAVESICAL PRESSURE

This is a continuation of a group of cases in figure 1

720 cc. (3 to 24 ounces) (fig. 3), evidence of loss of muscular tone through distension.

The clinical bearing of these observations is that in over-distension, it is the withdrawal of the first 100 cc. (2 to 4 ounces) that produces the major renal and circulatory shock. The sudden withdrawal of the first 30 cc. begins the vicious cycle. Therefore, the practice of partially (e.g., half) emptying the distended bladder, or completely emptying and partially re-

filling, is futile since the renal reaction has already been incited by the loss of the first few ounces.

To appreciate better the normal vesical pressure-volume limits, observations were made on a series of ten patients presenting normal bladders. The first six were subjected to the following procedure:

A No. 12 F. soft rubber catheter was introduced into the bladder and connected with a graduated water manometer.

	CASE											
	A	B	C	D	E	F	G	H	I	J	K	L
Age	18	60	52	72	64	62	58	74	56	63	61	50
Diagnosis	Reflex*	AP†	AP	AP	AP	AP	AP	AP	AP	AP	AP	AP
Retention (hours) approximate	24	24	18	24	24	24	18	28	24	24	12	24
Retention, cubic centimeters	720	870	780	1,830	1,170	1,320	675	2,070	1,110	1,440	660	915
Withdrawn (with 50 per cent relief), cubic centimeters	120	120	60	120	120	120	60	90	90	120	60	90
At 0 cm., cubic centimeter	180	90	180	720	210	300	125	540	360	420	180	285
Initial pressure (cm. water)	24.5	24.5	12.2	36	30.6	38.8	19	46.2	31.2	38	13.6	27.2

* Reflex due to acutely tender pilonidal cyst.

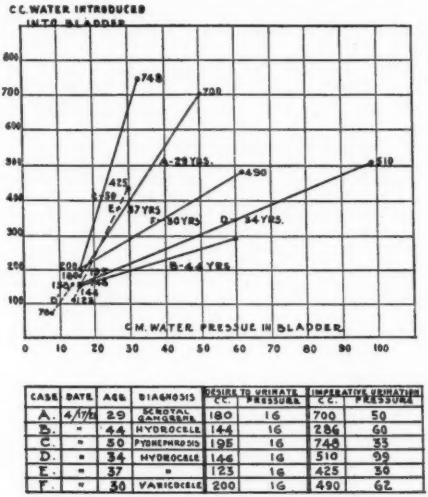
† Adenoma prostate.

FIG. 3

Potassium permanganate 1:10,000 was slowly run in until the patient felt the first desire to urinate, figure 4. The volume of fluid and bladder tension were noted. More fluid was then slowly run in until the pressure was reached against which the sphincters were about to give way, the point of imperative urination, indicated as *I*. This volume pressure was taken. All patients expressed the desire to urinate at

approximately the same pressure—16 cm. water, although the volume of fluid present ranged from 123 cc. to 200 cc. Greater differences both in pressure and volume were noted at the point of imperative urination, the pressure ranging from 30 cm. to 99 cm., the volumes from 286 cc. to 748 cc. This apparent variation in normal bladder capacities is noted clinically.

In one of the above cases (curve D′) the procedure was repeated



CASE	DATE	AGE	DIAGNOSIS	DESIRE TO URINATE		IMPERATIVE URINATION	
				CC.	PRESSURE	CC.	PRESSURE
A.	4/17/22	29	SCROTAL CARCINOMA	180	16	700	50
B.	"	44	HYDROCELE	144	16	286	60
C.	"	50	PYONEPHROSIS	195	16	748	35
D.	"	34	HYDROCELE	146	16	510	99
E.	"	37	"	123	16	425	30
F.	"	30	VARICOCELE	200	16	490	62

FIG. 4. GRAPHIC PRESENTATION INDICATING WIDE VARIATIONS IN PRESSURE-VOLUME LIMITS OF NORMAL BLADDERS

Curve *D′* is noteworthy since it illustrates the irritability of the bladder neck or deep urethra following instrumentation four hours previously.

four hours later and the effect of vesical neck irritation is manifested by greatly diminished volume-pressure values; the point of imperative urination being less than the point of desire to urinate in the original experiment. This, too, we frequently observe clinically in the frequency associated with irritation (inflammation) of the deep urethra and vesical outlet.

Four cases were then subjected to essentially the same pro-

cedure, except that in the first experiment (fig. 5), when the point of imperative urination was reached, the patient held the

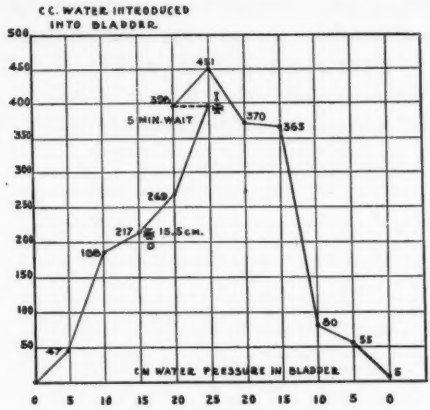


FIG. 5. EXPERIMENT 1. BLADDER DILATATION OF 53 CC. FOLLOWING FIVE-MINUTE WAIT AT POINT OF IMPERATIVE URINATION, *I*

It will be noted that during this wait, the bladder pressure decreased 5 cm. water.

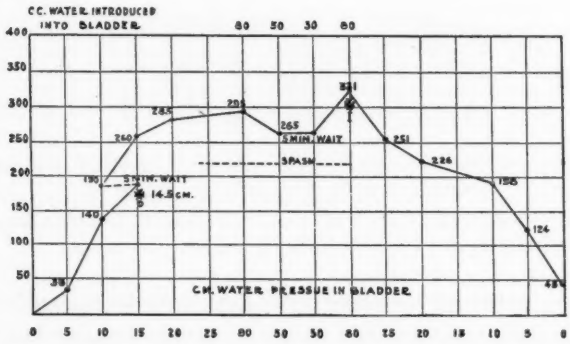


FIG. 6. EXPERIMENT 2. EFFECT OF FIVE-MINUTE WAIT AT BOTH POINT OF FIRST DESIRE TO URINATE *D*, AND NEAR POINT OF IMPERATIVE URINATION, *I*

At the latter point bladder spasm occurred

fluid at that point for five minutes. During this time the bladder pressure was found to drop 5 cm. so that it was possible

to run in 53 cc. before the point *I* was again reached. The fluid was then slowly withdrawn; the volume present in the bladder was recorded with each 5 cm. drop in pressure, and the amount present at zero cm. also determined. (In this first experiment the residuum was 5 cc.)

In experiments 2, 3 and 4 (figs. 6, 7 and 8) five-minute waits were made at both points *D* and *I*. At *D*, 70 cc., 110 cc. and 45 cc. fluid, respectively, were injected before the pressure of urinary desire again equalled that before the wait. At *I*, in experi-

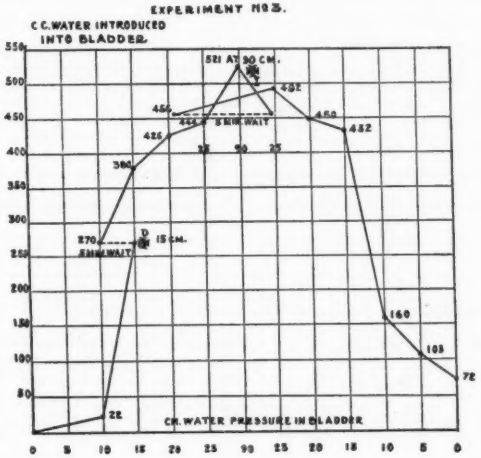


FIG. 7. EXPERIMENT 3. SAME AS FIGURE 6 EXCEPT THAT AT *I* A SMALL AMOUNT OF FLUID WAS RELEASED BECAUSE OF MARKED DISCOMFORT

ment 2, a bladder spasm occurred during which the pressure rose to 80 cm. In experiment 3, the sphincter withstood the great pressure of 90 cm. water, but the 72 cc. residuum at the termination of the observation attests great bladder stretching.

In all of these experiments it is to be noted that point *D* pressure is practically the same (14.5 cm. to 16 cm.), quite in harmony with the observations of Mosso and Pellacano. The volume at *D* shows moderate variation ranging from 180 cc. to 270 cc. The point *I* manifests greatest variations, a pressure range of 25 cm. to 90 cm. and a volume variation of 231 cc. to 521 cc. This, too, is

observed clinically, whereas one patient is acutely distended with but 12 ounces in the bladder, another may retain twenty before becoming equally uncomfortable.

Now it follows that if the bladder tension can be gradually reduced, greatest attention being given to the slow withdrawal of the first few ounces, renal shock and reaction will be minimized. By the same token, fall in blood pressure will be more gradual and renal function will be preserved, the vicious factors producing urinary suppression being eliminated. Apparatus heretofore devised to accomplish this has been dependent on periodic man-

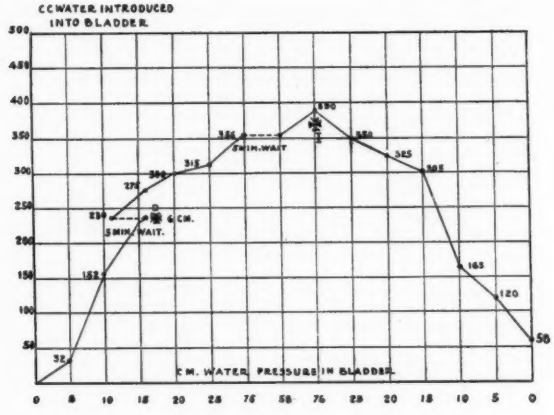


FIG. 8. EXPERIMENT 4. SAME AS FIGURE 6. NO SPASM

ual reduction of the water column against which the renal secretion must operate (Van Zwalenburg, Foulds, Shaw and Young). Exception to this is the faucet or slow drip principle as used by Cunningham, Boulanger, Heinberg, and others.

At Bellevue we have devised an instrument which not only permits recording of the vesical pressure, but automatically reduces this tension over a period of hours. This apparatus is essentially that described by Foulds (4) with an added clock release mechanism which permits gradual and continuous lower-

ing of the water column pressure against which renal secretion must function.

Having tested both methods, we prefer the gradual continuous tension reduction to the intermittent type in which the pressure is lowered periodically. There is not the series of hydraulic jolts to the kidney that accompanies the periodic release of a few ounces of urine. True, on deep inspiration, small quantities (15 to 20 cc.) may trickle over but the whole procedure progresses in a relatively stable manner. The stop-cock or slow drip method does not and cannot take into accurate consideration the rate of urinary secretion which varies greatly from hour to hour.

In our experience catheter reaction is rather marked and seems to produce more local irritation than when used in the empty bladder.

To date our series of cases is small for we have only comparatively recently developed the automatic apparatus.

CONCLUSIONS

1. Overdistention of the bladder is the retention of urine beyond the point at which the normal desire to urinate is felt.
2. This normal desire to urinate is felt by the normal bladder at about a pressure of 16 cm. water.
3. Withdrawal of 30 cc. reduces the overdistention by at least 25 per cent.
4. Withdrawal of 120 cc. reduces the over-distention by at least 50 per cent.
5. In our series, the over-distended bladder reached zero pressure with a residual urine of 90 cc. to 720 cc.
6. Interruption of decompression permits an immediate increase in bladder tension.
7. Decompression should be continuous.
8. Moreover, decompression (if recurrence of over-distention is prevented by indwelling catheter) has accomplished its purpose when the blood pressure is stabilized.
9. Decompression need only be continued until the bladder

pressure has fallen to 16 cm. or thereabouts. Thereafter an indwelling catheter will take care of draining.

10. The optimum rate of decompression has not been determined. We are satisfied to complete decompression within twenty-four hours although the blood pressure is not always stabilized in this time.

REFERENCES

(1) Van Zwalenburg, C.: Emptying a chronically distended bladder. Jour. Amer. Med. Assoc., December 18, 1920, lxxv, 1711–12.

(2) Bumpus, H. C., and Foulds, G. S.: Gradual emptying of the overdistended bladder. Jour. Amer. Med. Assoc., 1923, lxxxi, 821–23.

(3) O'Conor, V. J.: Observations on the blood pressure in cases of prostatic obstructions. Arch. Surg., September, 1920, i, 359–67.

(4) Foulds, G. S.: The gradual withdrawal of residual urine from the chronically overdistended bladder. Jour. Urol., May, 1921, v, 453–459.

BLADDER SPASM AND THE BLADDER SPLINT

EDWARD L. KEYES

New York

Shortly after "decompression" was first called to our attention as a method of slowly and safely relieving the overdistension of aged bladders, a prostatic patient was sent me whose uninfected, overdistended bladder reached above his umbilicus.

Here was a case for experiment. I put him in bed in the hospital, clamped a soft rubber catheter, tied this into the urethra, loosened the clamp sufficiently to permit the urine to flow in rapid drops, placed a large basin between his thighs, and went off to make rounds.

At the end of two hours I returned to find the catheter dripping merrily, the basin half full of water and the patient half full of water too—his bladder now half way to the umbilicus. I did not care to desert him in this state (not being fully converted to the dogma of decompression) and yet I foresaw that waiting would be a tedious job, for surely the emptier the bladder, the less its internal pressure and the slower its progress toward complete emptiness. Indeed, thought I, if that bladder were a rubber ball, its excessive pressure would long since have vanished. So by way of experiment I replaced the pan with an empty one, pinched the catheter, removed the clamp, held the indwelling catheter upright (an elevation of some 3 inches above the belly wall) and cautiously released its tip.

Not a drop flowed. I lowered the catheter to the level of the belly. Not a drop. Roughly estimated, the intravesical pressure was zero. Hence one might as well empty the viscus. I dropped the catheter into the pan. About 1000 cc. came away. I measured what had been passed in my absence: about 1300 cc.; 2300 cc. in all. From that day I have had no deep interest in

the theory and practice of decompression, as generally understood, beyond fortifying my impressions by Dr. Campbell's observations, which you have heard, continuing (to my entire satisfaction) the practice of emptying the overdistended bladder drop by drop until the pressure was off—then draining over the side of the bed, and concentrating my clinical interest on bladder spasm.

Overdistension of the bladder reduces its physiological capacity; i.e., the amount of urine it will hold with comfort. This fact is known and is illustrated by some of the experiments in Dr. Campbell's paper.

Repeated overdistension of the bladder progressively reduces its physiological capacity. This fact is illustrated by the prostatic in acute retention, from whom the first catheterization draws a liter or more, and from whom casual intermittent catheterization thereafter draws smaller and smaller amounts until infection supervenes and reduces the capacity to perhaps as little as 100 cc. or so.

The extreme of this diminution of bladder capacity is seen in the so-called strangury of cancer, stone, tuberculosis, streptococcus viridans infection (Hunner ulcer), etc. Such a bladder becomes so sensitive that its very contractions cause more pain than its distention. The pre-micturition pain is exceeded by the terminal spasm, which at its worst gives rise to that unremitting exquisitely painful cramp termed strangury.

Derivation of the urine usually relieves strangury. Thus bilateral ureterostomy usually relieves the pain of vesical tuberculosis or carcinoma. Suprapubic fistulization may achieve the same end. Also it may fail. Who among us has not been dismayed to find the desperately sick prostatic, after a neat suprapubic fistulization, continue his bladder spasms until they wore him out.

Yet Hinman some years ago reported two cases of bladder tuberculosis relieved of spasm by continuous irrigation. Such clinical facts cannot be correlated on the theory that the mere presence of fluid in the bladder is the source of spasm. Rather the spasm is due to bladder sensibility so exquisite that the

least variation in pressure within the bladder from whatever cause brings on spasm.

We may note that the most desperate cases of bladder spasm are habitually associated with grave renal insufficiency, which itself makes the patient generally hypersensitive. This fact, combined with the difficulty in relieving bladder spasm by local measures, has confused the issue in the minds of many and lead them to attribute the bladder hyperesthesia fundamentally to a general hyperesthesia. It seems more prudent to attribute bladder spasm primarily to a bladder hyperesthesia, increased perhaps by a general hyperesthesia.

To relieve bladder spasm I have applied a modified decompression apparatus, to act merely as a bladder splint. In practice the bladder splint is by no means a panacea. Urethral hyperesthesia may make the catheter unbearable (I have not used it through a suprapubic fistula with any success). Masses of pus, tumor or blood clot may plug the catheter. If the nurse is not alert, your safety valve blows out with a terrific spasm, and the patient, if he has any sense, will not let you replace it. But it is the only way to stop inflammatory bladder spasm immediately and to give the bladder that rest which permits it to get a new start, as it were.

The apparatus is that of decompression; viz., an open tubing attached to an indwelling catheter, terminating in a U-tube over the top of an irrigating can. The elevation required is so slight that one omits the manometer as of no importance. Indeed, the elevation should be no more than 6 inches at most above the level of the bladder, and the correct application of the apparatus, upon which its efficiency depends, requires the utmost gentleness and patience.

The most sensitive patient upon whom I have successfully applied the bladder splint was one of Dr. O'Crowley's. The patient was dying of bladder spasm incident to a prostatic carcinoma. Operation had relieved the retention of urine, but strangury had set in, and when I first saw the patient, he was having hourly spasms of the greatest intensity in spite of narcosis. Even the insertion of a catheter sent him into a spasm.

It took over an hour to anesthetize his urethra, tie in a clamped catheter, attach a tube leading to the foot of the bed, remove the clamp and permit the tube to fill with the patient's own urine, while this tube was gradually lowered to the level of the bed as it filled. My impatience led me to elevate the end of the tube just enough to trickle a few cubic centimeters of boric acid solution into it. Immediately a spasm set in, and this was as promptly relieved by lowering the end of the tube to the level of the bed, at the foot of which the can was fixed without any elevation whatever. The only back pressure came from the length of the tubing and the inch or two the patient's buttocks sank into the bed. Yet for four days the relief from spasms was reported to me as complete. The tubing then became plugged, the spasms returned, and within forty-eight hours the patient expired.

It would be unprofitable to detain you with the recital of my many happier applications of the bladder splint, notably in cases of prostatism and Hunner ulcer.

DISCUSSION

Dr. ALEXANDER RANDALL (Philadelphia): May I say just a word, after Dr. Keyes' graphic description of the suffering of these individuals, which I am sure we have all experienced?

Along this line, we had an idea that we thought might bear fruit and possibly will in somebody else's hands, although we have not had much success with it.

We had a man with a vesical carcinoma and had made a suprapubic fistula, which we had hoped would relieve his spasm, and although it was quite competent it did not deter his continual strangury.

In talking it over with one of the neurological surgeons, we conceived the possibility of trying to kill the sensory nerve fibers from the base of the bladder by alcohol injection, as though we were doing a sacral nerve block. Dr. Moorhead did the work and felt sure from the peripheral anesthesias obtained in the lower extremities, that he could tell pretty accurately that he got some of the sacral roots, which also supply the bladder base.

The patient's condition did not allow really of a long period of study and our first injection apparently gave us very good anesthesia in the peroneal muscles and the skin on the side of one foot. The method, however, holds forth promise, and I think if the technique were developed, it might well be used in these cases and simply by a nerve-block injection, we could actually kill these sensory fibers to the bladder and save the misery of these otherwise uncontrollable cases.

Dr. JOHN H. CUNNINGHAM (Boston): I am sorry I did not hear all of Dr. Campbell's paper. I have heard his conclusions, however.

At the Stockbridge meeting, I presented a decompression apparatus which we have used successfully, and showed, by charts, that we get a very rapid drop of systolic blood pressure,

if the decompression apparatus was not used in cases of large retention and this undesirable feature can be avoided by gradual decompression of the bladder retention.

In Dr. Campbell's conclusions, I think I heard him say that the indwelling catheter should not be used until the systolic blood pressure became stabilized, and that stabilization of systolic blood pressure often occurred in twenty-four hours.

Dr. EDWARD L. KEYES (New York): Bladder pressure, not blood pressure; pressure of the urine inside the bladder, not blood pressure.

Dr. CUNNINGHAM: I thought Dr. Campbell said the blood pressure. If I am wrong about that, the point I am trying to bring out is lost. (Laughter.) May I ask you about that, Dr. Campbell?

Dr. MEREDITH F. CAMPBELL (New York): What I said was that when the blood pressure was stabilized, the indwelling catheter should be applied.

Dr. CUNNINGHAM: And that sometimes occurs in twenty-four hours?

Dr. CAMPBELL: Yes, I said that we decompressed at Bellevue Hospital in twenty-four hours.

Dr. CUNNINGHAM: And you feel at that time that the reaction from your high circulatory tension is going to be largely overcome?

Dr. CAMPBELL: Yes. It is not true in all cases, but it is in probably most of them.

Dr. CUNNINGHAM: I am back again where I started.

Our experience with decompression in cases of large retention, is that the decompression prevents the rapid drop of systolic blood pressure which we think is so bad. We find that our sys-

tolic blood pressure does not become stabilized under two or three days, sometimes longer, and I agree that the decompression should be continued until that stabilization of the circulation is evident, when constant drainage, of course, will keep it constant. I am rather surprised to get the idea from Dr. Campbell's communication that the systolic blood pressure dropped off so rapidly with decompression that stabilization can be arrived at in twenty-four hours. This idea is quite contrary to our observations.

Dr. HERMON C. BUMPUS, JR. (Rochester, Minn.): Our experience has been similar to Dr. Cunningham's, in that it has been a good deal more than twenty-four hours, generally the third, fourth or even the fifth day, when we have obtained a minimum systolic blood pressure. We felt also that this was the important point about the decompression. We believe that the Van Zwalenburg apparatus gradually reduces the pressure because at no time do you release any great amount of urine with it. When the apparatus is rigged up, and the patient put quietly in bed, in about twelve hours the pressure will drop from ten to fifteen centimeters. Then the U-tube can be lowered just above this point, so that at no time is there any sudden release of pressure.

We have not felt the necessity for clock attachment.

RESULTS OF PUNCH PROSTATECTOMY

HERMON C. BUMPUS, JR.

Section on Urology, Mayo Clinic, Rochester, Minnesota

In four years a century will have elapsed since Guthrie first called attention in his lecture before the Royal College of London to bar formation at the neck of the bladder. Yet at the present time this recognized pathological entity, because of its situation, produces symptoms analogous to those of prostatic hypertrophy and is looked upon and treated by many surgeons as if due to such hypertrophy rather than, as Randall has so clearly demonstrated, to prostatic atrophy with associated inflammatory changes. Randall states: "One frequently hears reference made to the removal of a 'small sclerotic prostate.'" That this operation is fraught with many difficulties and some dangers hardly needs mention to anyone who has attempted it. To remove the clearly encapsulated lobes of the benign hypertropic prostate is a very simple procedure, but to drag from its bed the atrophic, adherent and sclerotic tissue which frequently forms a part of the condition of median bar formation is an operation taxing not only the energies, but the utmost skill and anatomical knowledge of the operator; while the dangers from injury to contiguous structures by hemorrhage and from actual failure to remove anything should contraindicate such a procedure.

Young, commenting on such a surgical procedure, states: "The amount of tissue removed at suprapubic operation is so small that it seems ridiculous to have to perform suprapubic operation for its removal." To overcome these valid objections has been the object of the various instruments invented for intraurethral use. Although many of these are well known,

I shall briefly sketch their development, since several were employed in the series of operations the results of which I wish to report, and one in particular, designed by Braasch, seems to meet all the needs most satisfactorily.

The various instruments classify themselves into two groups, those intended to incise the obstruction, and those that do excise it. Guthrie constructed the first instrument for incision, which consisted of a small knife-blade made to project at will from a catheter. In describing the operation he states: "The knife being projected just as the instrument is felt to be passing over the bar will cut it and, if after it has passed into the bladder it be withdrawn, the little knife in coming back will enlarge the original cut. Civiale elaborated this instrument, and it was brought to its greatest perfection by Geraghty in the form of his sphincterotome. These instruments, however, because they incised rather than excised the obstruction, never proved satisfactory in any considerable series of cases, although in individual cases success was not infrequent.

Mercier was the first to design an instrument for excision. This resembled a Bigelow lithotrite, the movable jaw of which was constructed as is a circular knife. The instrument was clumsy and difficult to manipulate and, therefore, not generally adopted. In fact, being invented in 1841, it appears to have been forgotten until Young presented his punch in 1911, when, in a review of the older literature the description of Mercier's instrument was resurrected. Except as to uniformity of use they have no resemblance. The Young punch accomplished so thoroughly the work for which it was designed that it soon became the accepted instrument. However, it appeared to have two serious limitations: adequate vision of the field of operation was not possible, and only after application could the piece of tissue to be removed be seen protruding through the fenestra into the endoscopic tube. Even this delayed and limited view was not satisfactory after the first cut, because of resulting hemorrhage.

In referring to this objection, Young states that in practice he has found this observation of the tissue projecting through

the fenestra entirely unnecessary, as with experience one may be certain as to the portion of the prostate which has been caught within the tube. Caulk, on the other hand, is equally emphatic concerning the necessity of this preliminary inspection of the tissue to be excised in order to prevent cutting other portions of the bladder or urethra. An unfortunate accident occurred to me when I neglected to observe this precaution. Feeling that well over 50 cases had furnished the required experience to make this preliminary observation unnecessary, I dispensed with it and engaged the bar formation blindly. I was not mistaken regarding the application, but unfortunately, a fold of bladder was also engaged and death occurred. Young reports a similar accident in his series of 355 cases, although it was not encountered by himself. Recently I have learned that our own respective clinics are not unique in the experience of such unfortunate accidents.

To avoid such a complication by rendering the operative field easily visible at all times, Braasch in 1918 added a knife-punch, after the model of Young, to his direct cystoscope. The difficulty of adequate vision during operation being thus overcome, the question of hemostasis remained. As Young says in his recent book, in the majority of cases this is not excessive, but is annoying and occasionally demands transfusion and has compelled suprapubic cystostomy for control. He, therefore, so modified his punch as to carry a cautery blade with a water cooling system. As serious bleeding occurred so seldom, he did not urge this modification for general use, and yet I think I am safe in saying that the fear of being unable to control hemorrhage following the punch operation has been the most serious obstacle to its more general adoption. In 1920 Caulk adapted to the Young punch a much simplified and efficient cautery-blade and at once practically eliminated the possibility of hemorrhage. To him is due all credit for popularizing this method. In 72 of the cases reported here his instrument was used, and serious bleeding immediately following operation occurred but once. However, when one compares the records of these 72 cases with the 52 cases in which the knife punch of either Young or Braasch

was used, a high incidence of two serious complications inherent to the use of a cautery is noted, which seems to us to offset the advantages of immediate hemostasis. I refer to the occurrence of delayed bleeding and prolonged febrile reaction.

The delayed bleeding usually occurs from ten days to three weeks after the operation, at the time the slough comes away. If there has been no febrile reaction compelling the patient's extended stay in the hospital, one is usually informed of this unexpected hematuria by wire and is placed in the distressing position of trying to apply hemostasis by telegram. Fortunately, such bleeding is usually more alarming to the patient than serious.

The occurrence of prolonged postoperative febrile reactions is more trying. In the 72 cases in which the cautery was used, febrile reactions lasting more than three days occurred in twenty-three, a third of the cases. The short febrile reactions lasting from one to three days were far more severe than we experience when the knife is used. In the 42 cases of knife-excision there were only eight with febrile reactions lasting more than three days, the longest being twelve days, while when the cautery was used some of the reactions lasted for several weeks. It would seem that a cauterized area in the neck of the bladder is more prone to secondary infection than a cleanly incised one and hence a better focus for a secondary pyelonephritis. The increased time that it requires a burn to heal, in comparison to a clean incision, would more than double the time in which such an infection might take place. The incidence of epididymitis was also much greater in the series with treatment by cautery, occurring ten times, while it is mentioned but once after the use of the knife.

In an endeavor to insure against hemorrhage following the knife-punch, I formed the habit of immediately cystoscoping the patient after the operation was completed. This made it possible to detect the bleeding points and, by applying the Bugbee electrode with the bipolar current, to stop the bleeding with electrocoagulation. Recently Tolson has introduced an insulated shaft, for electrocoagulation after a punch operation, with

a contact point the size of the fenestra in the Young punch. This, of course, causes electrocoagulation of the entire excised area rather than just the bleeding points, and for this reason has the objections inherent to a cautery.

In this series of 114 cases there are complete records concerning the final results in seventy-four. As Caulk's cautery-punch has been used in the last 72 cases, the records of those cases are more complete than those of the 42 earlier cases in which the knife punch was used. The final results are also much better, due, I believe, to the larger caliber of the Caulk instrument rather than to the cautery feature. Thirty-five of the seventy-two patients report complete relief of obstructive symptoms and are satisfied with the results of the treatment, although one-third of them still complain of nocturia and frequency. The persistence of these symptoms after the obstruction has been completely relieved is unexpected until it is remembered that median bar formation is an inflammatory process and not the result of glandular hypertrophy.

The poor final results obtained following the knife punch (only four of twenty-two patients heard from expressed full satisfaction with the result of treatment) is due, I believe, to not having removed sufficiently large amounts of tissue; this was difficult to do with Braasch's original instrument. It may have been due, also, to the errors in technic invariably associated with the use of a new instrument.

Of the 114 cases, prostatectomy had to be subsequently performed in six, in one after six months, in one after four months, and in four a few days following the original punch. Possibly these were ill-chosen cases; in one the operation had been performed for adenomatous hypertrophy while in the other five cases the removed tissue showed inflammatory changes only.

We have not met with success when we have tried to remove prostatic tissue in the presence of lateral lobe involvement, although in the cases of true adenomatous enlargement of the median lobe its removal has met with good results.

The punch was used in three cases of malignant neoplasm of the prostate with transitory and indifferent results. Possibly

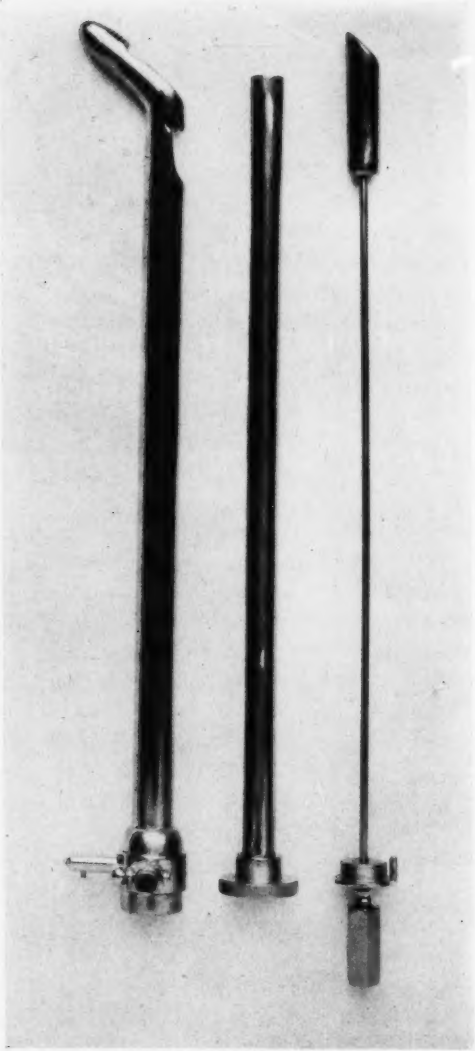


FIG. 1. BRAASCH'S MEDIAN BAR EXCISOR

a larger series would show greater relief of symptoms, but it has been our custom to effect suprapubic drainage when the obstruction from the growth is sufficient to demand surgical interference. In one case a neoplasm of the posterior urethra was easily removed by the punch when technical difficulties made its electrocoagulation impossible. In two cases contracture of the neck of the bladder in association with cord bladder was treated, one with complete relief of symptoms and residual urine and the other without result.

FIG. 2. PORTIONS OF MEDIAN LOBE WEIGHING 6 GRAMS; REMOVED WITH BRAASCH'S MEDIAN BAR EXCISOR

In Braasch's original instrument the caliber of the knife was small and it was difficult to obtain pieces of tissue of adequate size. It was because of this fact that I used Caulk's cautery-punch in the series of 72 cases cited, for the size of the bites obtained made the removal of the entire median bar easy. Recently Braasch has remodeled his median bar excisor so that it

now removes much larger pieces of tissue, and I believe that, by its use and its more accurate application under the guidance of the eye, results as excellent as we have obtained with Caulk's instrument may follow, without the annoyance of delayed bleeding or the high incidence of febrile reactions (figs. 1 and 2).

REFERENCES

(1) Braasch, W. F.: Median bar excisor. Jour. Amer. Med. Assoc., 1918, lx, 758–759.

(2) Randall, Alexander: Prostatisme sans prostate. New York Med. Jour., 1915, cii, 1123–1132; 1177–1186.

(3) Tolson, H. L.: Electrode for use with Young's punch; diathermy as supplement to prostatic punch operation. Jour. Urol., 1925, xiv, 63–65.

(4) Young, H. H.: Practice of urology. Philadelphia, Saunders, 1926, ii, 481–510.

DISCUSSION

Dr. Arthur H. Crosbie (Boston): I would like to ask Dr. Bumpus how it is possible with a punch to catch enough of the bladder, to do any harm. It is difficult for me to understand how the punch could get hold of a big enough piece of the bladder to produce a death.

Dr. Benjamin S. Barringer (New York): There are several interesting things that Dr. Bumpus has brought up.

I did not understand from him whether he used in the Braasch cystoscope a cautery following the punch, or not, or whether he just merely punched out. I have been impressed with the lack of value of cautery after punching operations. It seems to me that bleeding is better controlled right at the start than it is ten days afterwards.

I think there is nothing harder to control than bleeding from an infected prostate, the cauterization giving a good field for infection and I think this is the bleeding that it is almost impossible sometimes to stop, unless you use suprapubic operation, and even then it is hard. My own experience has been, in any series of cases of carcinoma of the prostate, that it is best to use a much larger, wider instrument, a modified Young instrument, so a larger piece can be bitten out.

I have always believed that the first bite you get is the one that counts. You put the instrument in the median line, depress it all you can, and take one good, solid bite; you get a good piece of tissue; then you turn it to four o'clock or eight o'clock, and very often you do not get a thing. Apparently, that one first bite relaxes the whole sphincter and you get but little afterwards.

We have been fussing lately with some means by which to control the hemorrhage at the time and it strikes me that that is the real thing that should be done. If you can control it for the first twelve hours the patient is all right.

We have tried very strong solutions of adrenalin and that apparently is working out to a certain extent.

Dr. FRANCIS R. HAGNER (Washington): Mr. Chairman, I have had some experience in intraurethral operations, and I have had quite an experience with the different types of punch instruments.

I may be considered a little radical in this, but I am not at all sure that we do not get better results in these punch operations when they are done under vision, or with the finger, either perineal section with the punch operation, or even with suprapubic operation.

I have had the experience (and I believe everybody has had it) that in the punch operation, very often when we make the first incision, just as Dr. Barringer said, it is difficult to get other pieces to engage in the instrument. And if you ever open these patients' bladders and do a punch operation with your finger in the bladder, you will be astonished at how much more you will get out than you can ever get out with an intraurethral operation.

Only a small incision has to be made. There is absolutely no danger of hemorrhage, as a small bag put in afterwards will undoubtedly control any bleeding. I am not at all sure that many of us will not come to that type of operation in these cases.

Dr. HENRY G. BUGBEE (New York): Last year I prepared a short paper for this Association but was unable to present it, and afterwards published it in the Journal of Urology. It covered just the point that Dr. Hagner has brought out, namely, the advantage in selected cases of doing a suprapubic drainage previous to the punch operation, and then guiding the punch with a finger in the bladder.

Many of these cases that require punch operations have an infected bladder, and the drainage prior to the application of the punch is of great advantage, not only in clearing up the infection, but in diminishing the congestion at the neck of the bladder, diminishing the size of the prostate, and lessening the possibility of hemorrhage at operation.

After a suprapubic drainage, it is surprising to see how the prostate contracts, and we really have a fibrous ring left, which is easily removed with the punch, under the guide of the finger; there is absolutely no risk connected with it.

I have continued to use this same method in probably a half dozen cases in the last year, and I am convinced that it is a satisfactory procedure.

Dr. JOHN R. CAULK (St. Louis): A good many points have been brought out this morning about this type of surgery. I think that we are all agreed that minor operative methods can be more frequently applied in the removal of this type of obstruction. I expected the paper and discussion to deal entirely with the remote results of the Punch operation, but many other features have been considered this morning and there are many things which seem entirely misunderstood.

In the first place with my Punch technique it is perfectly easy to have a thorough vision of the bladder neck and I personally have no trouble in discriminating between bladder and orifice. One can, under perfect vision, rotate the instrument in different segments of the bladder neck and remove whatever obstruction presents.

The accident of Dr. Bumpus is unfortunate, such things occur in any kind of work. It is hard to say how it could have happened unless there was marked redundancy of the bladder mucous membrane at the base, such as occurred in a patient of mine which I observed six or seven years ago; his intermittent obstruction was due to the fact that the mucous membrane of the base of the bladder protruded into the orifice if he stood. Certainly if one puts water into the bladder, removes the instrument until it ceases, it seems to me to be almost impossible to have this occur.

I feel after what experience I have had with this operation I can tell not only the bladder neck but the type of orifice whether glandular or sclerotic. As far as removal goes, a large bite is necessary in the bars and ordinary contractures; as Dr. Barringer has said, one big bite in the median line will usually correct the

condition. After such a segment is removed, if the obstruction is completely cut through, there is seldom any tissue left in the neighborhood on account of sphincteric retraction. In the larger obstructions, of course, multiple pieces must be removed either at one sitting or on repeated occasions.

The method of incising the neck seems to depend upon the fellow who is incising it. I see absolutely no excuse for opening a bladder in such conditions. Of course, congestion goes down by such drainage and prostates which apparently were large shrink to their fundamental process, sclerosis; this same result can be accomplished by an indwelling catheter. These patients should be prepared by an indwelling catheter in the same manner as for prostatectomy.

I personally feel after my experience with nearly three-hundred cases that the Cautery Punch method is extremely satisfactory and has accomplished excellent functional results. Concerning hemorrhage, I have seen but three instances of secondary hemorrhage in which the bleeding amounted to anything; in five instances only have I seen primary hemorrhage which gave us any concern, and in practically all of these cases there was a definite reason for it for instance, one patient became sexually excited, another patient was somewhat of a bleeder and had a pronounced diabetes, three other patients were done in the early process of development of the technique and resulted from mishaps in technique, the current being wrong. I have never had to open a bladder and in only one instance has it been necessary to evacuate clots through a Bigelow evacuator. The reason for this is not only due to the mild cauterization at the time but the care which has been exercised in post-operative attention, not allowing an inexperienced man to traumatize these individuals with catheters. I believe the indwelling catheter with constant drainage is a great safeguard.

I do not believe that high frequency sparking after incision of the neck is necessary, nor do I believe recystoscoping or other instrumentation should be used. The less we manipulate such an orifice after the removal of the obstruction the better chance we have of minimizing bleeding.

The orifice should be engaged in the slot of the instrument, the neck infiltrated with novocaine. During this infiltration it is quite striking to notice the relaxation of the orifice and the ability to get more and more tissue in the grasp. During all this time pressure is steadily and firmly applied.

The field must be perfectly dry; I believe that irrigation at the time is contraindicated, a rapid cauterization rather than a steaming or boiling of the tissue is necessary. I have shown on numerous instances the pathological specimens removed and in many instances even the epithelium is preserved. The burning should take not over four seconds.

The mistake which some men have made has been to engage the obstruction with the cautery blade and the moment the current is applied before the blade had become heated to immediately drive the instrument home; in such a way the blade is often bent and broken and tears have been made. This should not occur.

I thought it might be of interest to you to know the late results on my patients who were operated on from 1920 to 1924 inclusive, a period of from two to six years after operation.

In 1920 we have followed 26 cases, of these 80 per cent were bars and contractures, and 20 per cent large obstructions; 85 per cent showed permanently good results, 15 per cent poor; the poor results occurred usually in the small contractures and bars.

In 1921 we have followed 27 cases, of these 80 per cent were bars, 20 per cent large obstructions; of these 87 per cent gave perfect results, 13 per cent poor results.

In 1922 we have followed 18 cases, of these 72 per cent were bars, 28 per cent large obstructions; of these 92 per cent gave perfect results, 8 per cent poor results.

In 1923, 77 per cent were bars, 23 per cent gross obstructions; 87 per cent good results, 13 per cent poor results.

In 1924, 37 cases were followed, 60 per cent bars, 40 per cent gross obstructions; 84 per cent gave perfect results, 16 per cent poor.

Permanent good results, therefore, since 1920 showed a general average of 86 per cent good results and 14 per cent poor results. The poor results occurred much more commonly in the dense

tight contractures which tallys entirely with major surgery. I have noticed that if a man remains well for six months he usually will remain well forever.

Carcinoma of the prostate offers an admirable field for the Punch operation. I feel that suprapubic cystotomy is in the majority of instances entirely contraindicated. I am convinced that I can secure perfectly satisfactory urinary function in the majority of cases with the Punch operation since the obstruction from prostatic carcinoma is almost invariably of the contractile variety and seldom large. If it is large x-ray therapy or radium will shrink it sufficiently to allow the Punch operation to be applied with effect and in some instances relieve urinary obstructive symptoms without such an operation. I have done thirty Punch operations for carcinoma of the prostate; the duration of life has ranged from six months to four years, two lasting four years, one lasting three years, two lasting two years, making an average of two years. Seventy per cent had complete relief of obstruction until death; several required suprapubic drainage later; three of these cases were due to marked stonelike contraction from radium.

Dr. Edward L. Keyes (New York): Dr. Caulk has just said something to the effect that we are all agreed these minor operations are the best. They are the most convenient, but I discovered a good many years ago, in analyzing my results from 75 Chetwood operations (which I do not attempt to compare with these present operations, but which nevertheless were a minor attack on a prostatic obstruction), that just as we have to accept a three or five-year period in estimating recurrences of carcinoma, we have to accept a ten-year period in estimating recurrences of obstruction at the bladder neck.

I am, however, entirely in agreement with Dr. Caulk's statement that it is the fibrous rather than the adenomatous obstructions that will—shall we say immediately recur, or immediately not be relieved? It comes to much the same thing because the scar has not been wholly divided.

I agree with the previous speaker that you know nothing about

scar obstructions at the neck of the bladder until you have felt them with the finger, introduced through a suprapubic route. They present to the examining finger a tight ring more or less obstructing the entrance of the finger into the urethra. With some instrument, you punch out that tight ring, or divide it with a knife, and then beneath that there is a second, even denser ring. I confess to no anatomical observations upon these points, but I have looked upon the superficial contraction as a scarring in or about the mucosa, over the deeper, harder, denser scarring of the prostate.

I feel that I know more about the ten-year results of these operations than any of the rest of you do, with the possible exception of Dr. Frontz, who knows something about Dr. Young's earlier observations.

I have had the most permanent results from attacking these cases through a suprapubic incision with the Young punch, or with a very heavy rongeur forceps to bite out large pieces of the scar until you can feel suprapubically that no scar remains.

Then with the aid of a Hagner or Pilcher bag, to stretch the opening still further, there is some prospect that healing will occur in such a manner as to delay as long as possible the recontraction of the scar.

Dr. JAMES A. GARDNER (Buffalo): I would like to emphasize what Dr. Hagner, Dr. Bugbee and Dr. Keyes have said about suprapubic opening.

I found difficulty in days gone by, and still have difficulty by cystoscopic examination in making a diagnosis as to whether there is a bar or whether it is something more, because repeatedly after I have made an examination and said, "Well, this is a bar," when I get in the bladder I find a good deal more than a bar. Those are the cases in which, if we have done a punch operation, we later have to do a prostatectomy.

I feel that you can get this one bite that Dr. Barringer speaks of very much more satisfactorily when you are feeling with your finger, and with this modified punch which I have been using can make this bite count.

If a diagnosis of bar is made, and with our finger in the bladder find a small median lobe, it is easily shelled out. I feel that the drainage afterwards is the thing that relieves you of all danger of that night or the following night having to get up and do a cystotomy because the patient did not go according to Hoyle.

I see Dr. Caulk shaking his head, but they do bleed, up our way. (Laughter.)

Dr. WILLIAM A. FRONTZ (Baltimore): I regret that I cannot give Dr. Keyes any definite figures regarding the ultimate results. My feeling is, however, that the ultimate results have been good in cases in which the operation has been done for true contractures. Personally, I do not feel that it is an operation which should be done for prostatic adenoma.

I think one of the best methods possible in approaching cases of this kind, in order to be sure that you are dealing with the true inflammatory fibrous types, is to rule out the intraurethral type of hypertrophy. Frequently, these cases, on study of the vesical orifice show nothing, and with the ordinary cystoscope one cannot determine, of course, the condition in the urethra.

It has been my custom in cases of this kind within the last two or three years to employ the Greenburg instrument, which gives one a very good view of the urethra, and enables you to rule out these small intraurethral enlargements of the prostate, which may be playing the major rôle in the obstruction.

I feel that in most cases of contracture, a single cut, if it is made sufficiently deep, will succeed in relieving the obstruction and that the rimming out of the orifice around the whole three hundred and sixty degrees is unnecessary.

Dr. HERMAN L. KRETSCHMER (Chicago): The discussion has drifted along technical lines very much; I am sorry that Dr. Bumpus and Dr. Caulk have not talked more about their causes of failure, that is, failure of the various types of punch operations to relieve the symptoms.

We have checked over some of our cases in which the operation failed to relieve the patients of the symptoms. The operation

caused a disappearance of the residual and that sort of thing, but the patient still persisted in complaining of various types of distress that were present before the punch operation was done.

We have gone back and checked over those patients and found a good many of them had infections in the prostate and vesicles which ultimately caused a disappearance of their symptoms by massage, hot applications, and sitz baths and instillations. So I think in some of these patients we have failures because we fail to treat them for existing infections in the prostate itself and seminal vesicles.

Regarding the use of the punch in carcinoma, we have had some cases of carcinoma that we have punched out and we have had very delightful results in that it has relieved the patients of their symptoms and of their obstructions—not cured them, of course, but it has been a very simple way in which to give them relief.

One other point with reference to doing the punch operation through the open bladder: It seems to me when you open the bladder that it would be very much better to do a wide resection. I have always felt that if it is necessary to open the bladder, a wide resection should be done.

Dr. JOHN H. CUNNINGHAM (Boston): I long ago came to the conclusion that there is a place for the punch operation. I have employed it for a good many years, using the various new and modified instruments that have become available from time to time. I believe the good results are in direct proportion to the proper selection of cases.

Unfavorable results attending the operation are still present, chief among them being that in some instances we do not get a cure in a single operation. While this is not pleasing to us and of course quite discouraging to the patient, the operation nevertheless has much to recommend it.

After considerable experience, I have come to a certain pretty definite classification for the selection of cases and for the use of the various forms of the punch and the manner in which it should be used. For the small, very discrete, unquestionable growths at the bladder neck, which can be removed by one cut, we use the

Caulk punch. We have had little hemorrhage and good results.

There is another much larger group in which the obstruction is larger than we feel can be removed entirely with one cut. This group we deal with through a perineal section, the chief reason being that we can determine exactly how much tissue should be removed by multiple cuts. By doing a median perineal section, and performing the operation through this wound, the finger is the guide as to how much we have to do, and we can do as much as we choose.

Another advantage of the perineal section approach is that not infrequently I have found obstructions in the urethra which would have been missed without the open wound and digital investigation.

The perineal incision permits of placing a large De Pezzer catheter to control hemorrhage. Early in our experience we found that occasionally we had to do a subsequent perineal section to control hemorrhage.

As for doing the operation with the open bladder, we have had some experience when we have approached an obstruction through the bladder, the condition encountered (usually carcinoma) may cause us to prefer to use the punch to any other method to relieve the obstruction. I want to corroborate what has been said about the amount of tissue sometimes present and the advantage in having an open wound either suprapubic or perineal to remove it all.

Dr. Hermon C. Bumpus, Jr. (Rochester, Minn.): I am sorry I did not make myself more clear to Dr. Barringer in regard to our method of hemostasis. After I have completed the punch operation, I always use a direct cystoscope to find the individual spurters; then, with Dr. Bugbee's electrode, I electrocoagulate each one of them and you get complete hemostasis in a very short time, permanently. As a result, we have given up the use of an indwelling catheter after the operation and the patients go back to bed absolutely dry.

There has been a great deal of emphasis placed on the first or median cut as being the best one. I think this is due to using

instruments in which you have not vision, for after you have made the first cut, the tendency is for all other cuts to fall into that sulcus. From the slide I showed you, you could see that the pieces of tissue removed were all of about equal size. Too, when you have vision, you can place your instrument in any part of the sphincter you desire and subsequent cuts will be quite as good as the initial one.

I agree with Dr. Caulk about preparation. We have prepared these patients before operation the same as we would prepare them for a suprapubic prostatectomy.

In those cases where we had intraurethral enlargement in lateral lobes, we have not been able to get satisfactory results. With this direct cystoscope of Dr. Braasch's, you can see those lateral lobes easily and after removing the medium they naturally overlap more than before.

Dr. JAMES A. GARDNER (Buffalo): After suprapubic cystotomy various methods have been used to take care of drainage.

If rubber drainage tubes are used they will keep the patient more or less dry, but delay the healing.

If absorbent pads and cotton are used they practically form a urine poultice.

Some years ago Dr. Edwin Beer brought out a suprapubic cup made of hard rubber which is attached to the abdomen by an adhesive plaster mass supplied by Johnson & Johnson. This cup seemed to provide a most satisfactory and economic method of caring for the drainage in these cases.

It was found, however, that the hard rubber flange of the Beer cup would not fit a certain type of abdomen. The cup has been modified by making the flange or skirt of soft rubber and the outlets for the drainage tubes have been increased in caliber.

The adhesive mass is soluble in benzine. The evaporation of the benzine in the mixture can be hastened by heating. The mass should be of the consistency of tar when spread on the rubber flange. The cup is now ready to apply over the wound and is re-enforced by strips of adhesive plaster.

The skin should be dry before applying the cup. This is one of the most important parts of the technique.

If a larger catheter is placed in the suprapubic opening, or an indwelling catheter placed in the urethra for four or five hours, so that the adhesive mass has a chance to become thoroughly attached, the cup will keep the patient absolutely dry.

Following a prostatectomy the cup should not be applied until the drainage is sufficiently clear so that the drainage tubes will not become plugged.

The drainage tubes are placed in a urinal between the patient's legs, or permitted to drain in a bottle when he is out of bed.

HOUR GLASS BLADDER RELIEVED BY PROSTATECTOMY

HENRY H. MORTON

Brooklyn, New York

R. J., fifty years of age, married, Syrian, a laborer, had always had good health until three years ago, when he began to suffer from backache and frequency of urination, eight or ten times a night, every hour by day, accompanied by straining and tenesmus. Urine purulent and foul, with much pus. The patient has had one slight attack of hematuria.

Examination per rectum showed the prostate moderately enlarged, with hardness and fixation.

Residual urine, 2 ounces in amount.

Cystoscopic examination showed marked trabeculation of the bladder wall and enlargement of the right lobe of the prostate, but no median enlargement. A small round depression was also noted on the posterior upper wall, which had somewhat the appearance of a diverticulum. A cystogram showed a small irregularly outlined bladder with a posterior irregularity resembling a large diverticulum.

Although the history was not characteristic, from the appearance of the cystogram, it appeared as though we had a diverticulum of the bladder to deal with, and I decided to extra-peritonize the bladder after the method of Voelcker, described by him first in 1921.

Operation. The bladder was filled with water, and an incision made through the abdomen, from the symphysis nearly to the umbilicus. The bladder was exposed and the serous membrane covering it incised transversely and pushed back to the peritoneal fold as far as possible. This was easily done until the insertion of the urachus was reached. At this point the peritoneum is attached closely to the bladder, like the skull-cap on a monk's

head, and it is impossible to separate the peritoneum from the bladder. The anterior layer of peritoneum was then incised transversely, and at the posterior edge of the portion of the peritoneum attached to the bladder another incision was made

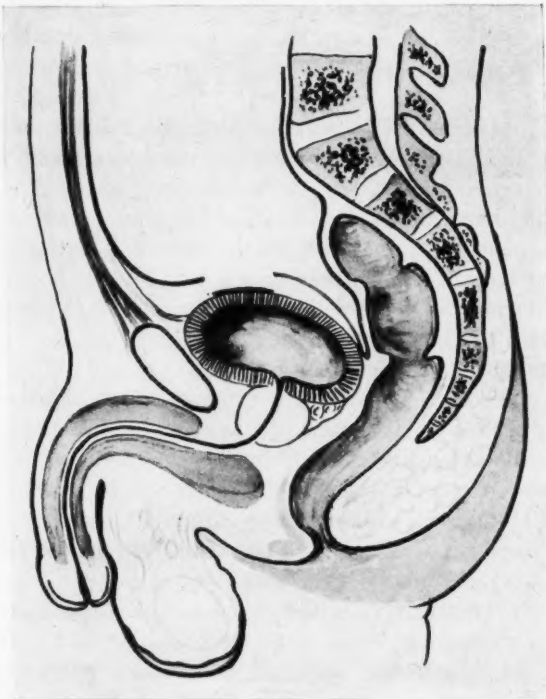


FIG. 1. PERITONEUM INCISED IN FRONT AND BEHIND. ADHERENT PORTION OF PERITONEUM ATTACHED TO FUNDUS OF BLADDER

leaving an elliptical piece of peritoneum adherent to the upper portion of the bladder. From this point it was easy to push the peritoneum away from the bladder behind and at the sides until the ureters and great vessels were exposed laterally and the rectum posteriorly. The transverse incision in the peritoneum was

closed by sutures and the bladder was thus completely mobilized and placed outside of the peritoneal cavity. After extraperitonizing the bladder it was possible to examine its posterior surface in search of the diverticulum, but none was found. The bladder

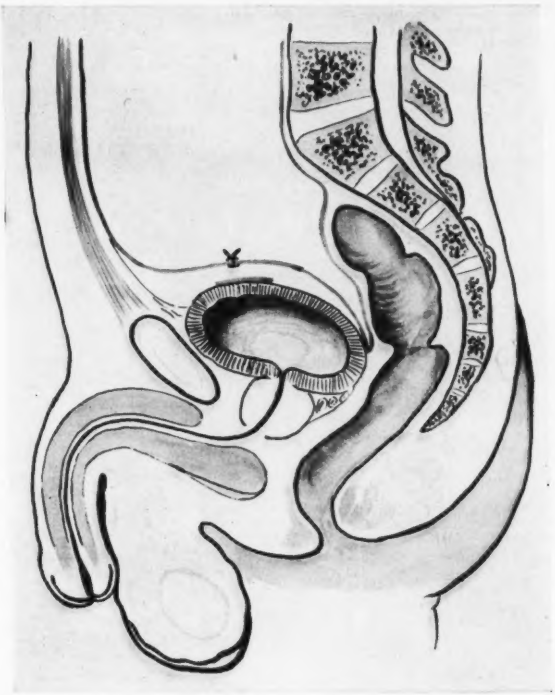


FIG. 2. INCISION IN PERITONEUM CLOSED BY SUTURE AND BLADDER EXTRA PERITONIZED

wall was smooth and without any projecting pocket. The bladder was then opened by making an incision in its anterior wall, and its interior was explored. No diverticulum was found, but a large hypertrophied prostate was felt projecting into the bladder cavity. No attempt was made to remove the prostate at this time. A large drainage tube was placed in the cavity of

the bladder and the wound closed around the tube and the abdominal wall sutured.

Three weeks later a second-stage prostatectomy was done and the prostate enucleated without difficulty through the suprapubic wound. The wound close in three weeks and the patient passed all his urine through the urethra. A cystogram showed a normal oval-shaped bladder.

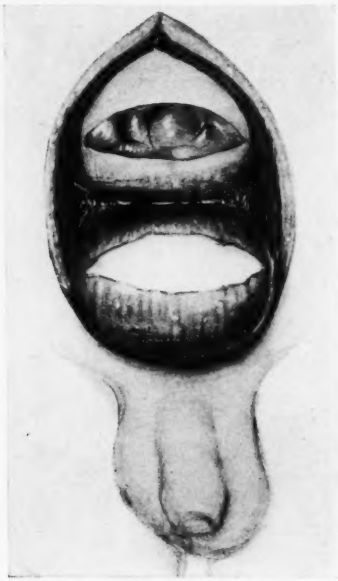


FIG. 3. ELLIPTICAL FOLD OF PERITONEUM ATTACHED TO FUNDUS OF BLADDER AND TRANSVERSE INCISION IN PERITONEUM

It was evident that on account of the straining on urination instead of all the muscular fibers being of equal strength, some had given way while some lateral bands had not relaxed with the others, but remained tense and caused a constriction of the middle portion of the bladder, resembling the contraction of an hour glass, but as soon as the obstruction to urination was removed by suprapubic drainage and extirpating the prostate, the overstretched

muscle bands recovered their tone and all the fibers worked again in harmony, and the bladder was restored to its normal shape.

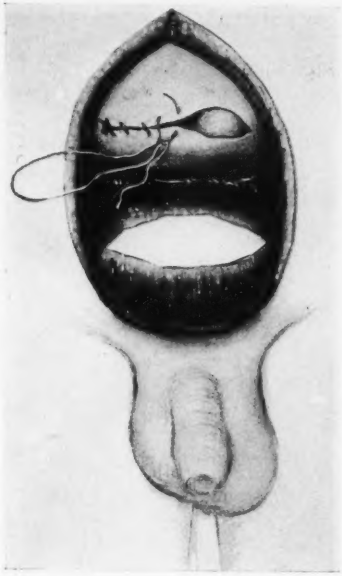


FIG. 4. TRANSVERSE INCISION IN PERITONEUM CLOSED BY SUTURE

FIG. 5. CYSTOGRAM OF BLADDER SHOWING IRREGULAR DISTENTION BEFORE OPERATION

FIG. 6. CYSTOGRAM OF BLADDER SHOWING RETURN TO NORMAL SHAPE AFTER OPERATION

A DEVICE FOR THE CONTROL OF HEMORRHAGE FOLLOWING SUPRAPUBIC PROSTATECTOMY

W. W. TOWNSEND

Burlington, Vermont

The control of hemorrhage following suprapubic prostatectomy is, in our mind, still a technic which needs perfecting.

The blood, following enucleation, comes principally from many small twigs of the inferior vesical and middle hemorrhoidal arteries, as well as the oozing from the prostato-vesical plexus.

Numerous plans for the control of such hemorrhage have been, and are, in use, for example, the removal of all glandular masses —thus allowing the cavity to contract as a pregnant uterus after delivery. This procedure is very simple for the surgeon, but is frequently the reverse for the house staff, affording them anxious moments until a secondary hemorrhage has been arrested. Then there is the control of the bleeding by digital pressure from the rectum and bladder, the stitching of the capsule and the ligation of vessels, the packing of the prostatic cavity with gauze and the use of the hemostatic bag as devised and used by Hagner and others.

However, to us there are objections to all these methods. What we desire is complete hemostasis and the absence of any foreign body in the cavity of the bladder after the patient leaves the operating room.

By means of the instrument that will be demonstrated we have in our Clinic accomplished this desire. In the experimental stage this instrument was left in place for a varying amount of time, from a few moments to a number of hours. It was found that the longer periods caused distress to the patient, for when the hemostat was removed the bladder had tightly contracted around it. Also, these long periods did not accomplish any more towards hemostasis than did the shorter ones, with the result that we now employ this procedure.

After the enucleation the staff is passed through the urethra, the point emerging at the suprapubic wound. Then the olivary tip is replaced by the large bulb. This is tightly drawn into the prostatic cavity, simply by withdrawing the staff. It is now held in position by an assistant for five minutes or more, depending on the amount of bleeding. This method will not

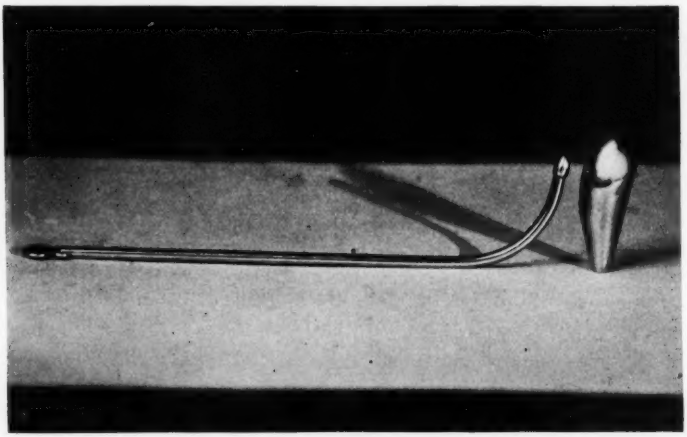


FIG. 1

only absolutely check hemorrhage but will iron out any tags which were left following the removal of the prostate. When the oozing has ceased, reversing the maneuver removes the hemostat. The bladder is then closed around a rubber drain which, we believe, hastens the closure of the suprapubic sinus, a point of tremendous importance to the patient.

THE RÔLE OF EPIDIDYMITIS AS A COMPLICATION OF PROSTATECTOMY

ALEXANDER RANDALL

I was wondering if we were giving the necessary attention to epididymitis and the rôle it plays in prostatectomy. Like stitch abscess or infected wounds, when someone asks the question of you, one's normal reaction is "Oh! yes, we have trouble occasionally," and if asked the percentage, we are apt to surmise about 1 per cent.

When an interne, a perverse spirit prompted me once to tabulate the subject of stitch abscess and failure of per primum union on a large general surgical service and the startling finding of 20 per cent broken down wounds almost cost me my job.

Are we not closing our eyes in prostatectomy to the frequency of an infectious morbid process—epididymitis—and not appreciating its importance, its frequency and the rôle it plays in the surgical recovery of our patients? I have gone over the last 100 prostatectomies that I have done with this in view and wish to present my experiences and conclusions.

The frequency of this complication varies in the few published statistics from those of Winburg White (1), who found it present to a certain degree in 82 per cent of 50 prostatectomies which he studied and in 33 per cent of them it occurred as an acute inflammatory complication with marked swelling, pain and suppuration. Eisendrath (2) expects this complication in 20 per cent of all cases. And while others mention lower figures, I am convinced few if any escape with an incidence less than 8 per cent and at that certainly a morbidity to be reckoned with, while probably the average is much higher than this last figure.

In my own 100 cases, acute epididymitis occurred 23 times

(23 per cent). Four times in the 34 perineal prostatectomies (11.7 per cent) and 19 times in the 66 suprapubic operations (28.7 per cent).

PATHOLOGY

Winburg White studied his cases on admission and recorded all changes then existant and checked against this any evidence found during the patient's hospitalization and surgical handling. It was this close study that raised his morbidity from epididymitis to the startling figure of 82 per cent, the majority fortunately being minor signs of infection without symptoms.

Undoubtedly, this picture varies according to the rules of virulence, resistance and soil, and rarely does the clinical course follow the familiar picture of gonorrheal epididymitis. In none of my 23 cases did suppuration develop to the point of abscess formation, or demand surgical intervention. In 2 recent prostatectomies where vaso ligation was done (at the time of first-stage drainage in one and before catheter drainage was instituted in the other), with resection of a small portion of the vas for study, we were very much surprised to find evidence of mural infection then present and the organisms were recognized in the tissues of the vas wall. I mention this as bearing on the moot question as to whether the infection in these cases is through the lumen, or extending up the lymphatics or vessels of the vas. The finding was contrary to my own conception of the route of infection which I had felt was by back pressure and intra-lumenal.

The prior existence of epididymal disease of venereal nature in youth can hardly play any part in the development of this complication in elder years though great weight has been put upon it by certain authors and some figures appear to bear out the suggestion. The idea of a latent focus of gonococci coming to light and activity is certainly stretching pathological processes to the limit and I believe the only part possible for such to play is that of "prepared soil" by lowered resistance and possibly a more patent vas or destroyed sphincter.

In 4 cases associated with perineal prostatectomy twice the complication was right sided and twice left. In the 19 cases in

which suprapubic prostatectomy was done, 6 times the right epididymis was involved and 5 times the left, and 4 times its occurrence was bilateral (in 4 unilateral cases the side involved was not recorded).

TIME OF OCCURRENCE

Of greater interest is the time of occurrence of this complication in relation to the surgical handling of such patients. The 4 cases complicating perineal prostatectomy showed that twice it occurred on the twelfth post-operative day. In one of these this was twenty-four hours after the first urethral urination; in another it occurred on the same day that continence developed. The third case developed several weeks after leaving the hospital perfectly healed, and the fourth, though occurring while the patient was still hospitalized, was nevertheless seven days after fistula closure.

In the 19 suprapubic cases with acute epididymitis, 5 developed before prostatectomy was done: 3 of these were on indwelling catheter drainage, 1 on periodic catheterization, and 1 developed spontaneously between a first and second-stage operation in a very decrepit individual. Eight times the complication developed during the post-operative period from the second to the twenty-fifth day, the most frequent time being at the end of the second or early in the third post-operative week when urethral voiding so often starts. Once it appeared forty-eight hours after the first urethral urination; once the day following fistula closure and 3 times closely following the passage of a urethral bougie. In the remaining 6 cases the complication developed after the patient had returned home completely healed and in one instance four months after hospital discharge.

RELATION OF PRIVATE TO WARD PATIENTS

I am convinced that in both mortality and morbidity studies there is a distinct difference as to whether one is dealing with private or ward patients and only those who serve in anyone of the large municipal hospitals appreciates the advantages of operating on private cases and the distinct disadvantage that one

labors under in trying to rescue some of the "surgical junk" (as Dr. Joseph Price liked to call it) that one falls heir to in doing such ward work. Of the 4 who developed epididymitis following perineal prostatectomy, 3 were ward cases and 1 a private patient. In the suprapubic series, 15 of the 19 cases, however, occurred in the private patients and only 4 in the ward work. This discrepancy is due to a much higher percentage of private patients (65 per cent) operated upon by the suprapubic method, for when all are grouped as either ward or private patients the ratio becomes 1 in every 6.43 cases for the private patients to develop epididymitis, and 1 in every 6.87 becomes the ratio for the ward material. A small divergence of no importance statistically, but explanatory of an apparently greater divergence when expressed in relation to the operative method.

RELATION TO MORTALITY

One of the 4 cases occurring in association with perineal prostatectomy died; a simple operation in a man of sixty-one years; he developed a right sided epididymitis on the twelfth day, it being likewise the day when vesical continence first manifested itself. His convalescence was unduly long and not until the thirtieth day did urethral urination occur, his perineal fistula being practically healed. On the thirty-seventh day the nurse found him dead in bed at seven o'clock in the morning in a position he was observed to be in on several inspections during the night. He died as he slept without suffering or struggle, and autopsy proved nothing. There were 2 deaths in the suprapubic group. In one an epididymitis developed before operation, and death was attributed to angina from which the patient was known to suffer. The second, a ward patient, who voided per urethra on the tenth day and the fistula healed on the twenty-fourth day. Epididymitis developed on the twenty-fifth day. The patient suffered from chronic otitis media which now became acute and he died of general sepsis ten days after suprapubic healing. This last was the only case in which sepsis in association with epididymitis shared in causing a mortality.

RELATION TO DELAYED HEALING AND CONVALESCENCE

The average perineal case became continent on the fourth day, voided per urethra on the eighth day and healed on the twenty-fifth day. The averages for the 4 cases with epididymitis were continence on the eighth day, per urethra on the fourteenth day and healed on the sixtieth day, showing a distinct delay in this group. Again in the suprapubic patients the average showed the first urethral voiding on the 12.6 day and suprapubic closure on the 25.6 day. In those with epididymitis these figures read 13.5 day and healing delayed to the 35.8 day.

We must, of course, take into consideration the possibility that a patient in a state of lowered vitality might be, at one and the same time, the slow healer and the more likely subject to infectious complications, but looking over the cases and recalling the individuals and their recorded pre- and post-operative conditions, with an occasional exception, there was no reason to expect the complication when it occurred and certainly one could not prophesy it, as there were an equal number, whose conditions would have warranted the development of epididymitis, yet who had none such. Therefore the relation of this morbid process to delayed healing is marked in this series.

THE RELATION TO OTHER COMPLICATIONS

Some of these remarks may be taken in extenuation of my high incidence of the complication. One only of the perineal cases deserves mention: an unfortunate instance of recto-urethral fistula, the same developing after hospital discharge and apparent wound healing. The fistula was due to a piece of packing left in the depths of his wound—his epididymitis was during early convalescence but recurred twenty-four months later and demanded orchidectomy. In the 19 cases following suprapubic operation, 3 had vesical calculi: 2 were diagnosed adeno-carcinoma: 1 had a post-operative pulmonary abscess (though spinal anesthesia was used and it was the opinion of the medical consultant that this complication antedated his operation); 1 had completely dilated ureters and a cystogram gave a bilateral

pyelogram (a most unusually poor risk with complete recovery), his epididymitis developed after going home: 1, as mentioned above under mortality suffered with chronic otitis media which became acute and death was due to general septicemia: 2 cases were such slow healers that only catheter drainage completed fistula closure on the forty-seventh and fifty-fifth days respectfully, their epididymitis developing in one pre-operatively and in the other post-operatively, and finally an unusually complicated and long drawn out case demanding a two-stage operation and eighty-eight days intermission in a most debilitated man of seventy years who suffered repeated attacks of bilateral epididymitis and was ultimately returned to splendid health by tertiary operative closure and bilateral vaso-ligation.

We have been, of recent years, so free of that disagreeable post-operative complication of a large sloughing and broken down wound that it is worthy of note that this distressing condition has played no part whatsoever in this series.

Though there were others who had calculi, who had cancer, one a diabetic, and others who had focal infections, i.e, parotitis, pyelonephritis, a case of post-operative intestinal obstruction, delirium tremens, etc., who did not suffer from epididymitis, nevertheless the recital of the above concomitant complication in those who did, certainly seems to associate lowered resistance or lurking infection to be of evil portent and significant prognostically.

TREATMENT

I have never felt called upon to employ surgical intervention in treating these cases of epididymitis. As mentioned above, in one case an orchidectomy was done two years later, simultaneously with an attempt to close a recto-urethral fistula and in a second case vaso ligation was performed to end recurrrent attacks at an operation for a tertiary closure. Support of the scrotum, hot compresses of saturated solution of magnesium sulphate until pain is relieved, and succeeded by a 5 per cent ointment of guaiacol to aid absorption, has been our routine procedure and has never led to focal suppuration, abscess rupture, or developed

the need of incision and drainage. With, but the one exception, just mentioned, recurrent attacks have not troubled us in any other instance.

PROPHYLAXIS

With the idea of crystallizing for a moment our attention on this subject and possibly at the same time developing a discussion of the proper prophylaxis, has been my reason for burdening you with this gloomy recital of some of my surgical short-comings. I am convinced that the gentlest post-operative handling is one essential, with the complete omission of urethral sounding unless fistula healing is delayed. Lavage in suprapubic cases is done daily; first per fistula, followed by a urethrovesical flushing by means of a metal nozzle, is our technic. This, I feel, is demanded in such cases in order to care for the inevitable sepsis in the prostatic cavity.

White in nine instances of two-stage prostatectomy had no cases of acute epididymitis and draws his conclusion that this two-stage procedure was responsible for the absence. Sixteen of our cases were done as a two-stage operation: 4 of them developed epididymitis.

And now the inevitable question: Are we justified in routinely doing bilateral vaso-ligation? And again, if so, when? With 5 of my 23 cases developing during the period of preparation, vaso-ligation to be worth while, should be done before drainage is instituted, or simultaneously with such, be it by catheter or suprapubic cystotomy. This we are now attempting to do and trying to make the same a dressing room procedure under local anesthesia. It has its dangers, its complications in private cases, its legal aspects in uremic patients, and yet having tabulated my misfortunes and chagrined to find this high morbidity, I feel that such a step and its concomitant responsibility is nevertheless to be assumed.

REFERENCES

(1) White, Winburg: Lancet, February 18, 1922, 321.
(2) Eisendrath: Canadian Med. Assoc. Jour., 1925, xv, 1037.

DISCUSSION

Dr. Henry G. Bugbee (New York): I would like to say a word in regard to Dr. Randall's paper.

During the past two years, we have made it a practice about once a week or once in ten days to gently strip the vesicles while the patient is in bed, and we feel that this has helped decidedly in diminishing the incidence of epididymitis.

In regard to control of hemorrhage following prostatectomy, you are probably familiar with the bag that Dr. Ballinger presented last year at the American Urological meeting. This is a very simple affair, which he has made in the hospital where he works, in Atlanta. It consists of a catheter, at the end of which is a small, thin rubber bag which is filled through the catheter in the same manner as a Hagner bag. Over this thin rubber bag is a skin cover, which acts as a protection and also prevents any adherence of blood clot to the bag. This bag is inserted in the same manner as the Hagner bag, is filled with fluid, the clamp is applied, and traction may be applied for an hour or two if necessary, or it may be allowed to remain in the bladder to be used in case of emergency.

A tube can be sutured in the suprapubic wound at the time of the operation so that the wound is closed about the tube and the patient goes back to the ward, if it is a second-stage operation, in just the same condition as he came up, with the same mushroom tube placed in the bladder. The following day, the only dressing that is necessary is to remove the clamp from the catheter, and the bag slips out very easily through the urethra.

We found, in using the Hagner bag, and afterwards in using the Pilcher bag, that the dressing on the day following the operation was often a severe trial to the patient, and this seems to me to be a very simple procedure. We have used it in probably a dozen cases and it has worked very nicely.

Dr. BENJAMIN S. BARRINGER (New York): I want to speak about Dr. Townsend's paper.

We have used for the last two years a device which is simply turning the Hagner bag upside down. The whole scheme is based on the Hagner bag, to which all credit is due. Our objection to the Hagner bag has been that putting a tube through the urethra and pinning it down to the thigh, or whatever device you may use, gives the patient a good deal of pain and makes him a little difficult to control.

We have used a solid, hollow tube, pulling the tube of the Hagner bag, which goes through the urethra, through this hollow tube; put the tube in suprapubically after the prostatectomy, and by pressure of this rigid tube upon the Hagner bag controlling the hemorrhage.

We have used this in twenty or thirty cases, and with one exception it has worked. We leave the bag dilated for about twelve hours, then let the air come out.

By the way, we simply dilate with air and not with fluid because the air comes out much easier. We leave the bag in for forty-eight hours, and then if the patient is all right, if the hemorrhage has stopped, the bag is very simply and gently taken out without any shock to the patient.

I have totally given up packing of the prostatic cavity. I had one patient die, I think directly because of the shock entailed upon removing a very adherent packing in the prostatic cavity. He did not bleed afterwards, but he promptly died. He may have had an embolus, I do not know; there was no autopsy.

There is a class of cases in which the Hagner bag is apparently not useful, and that is the type of case in which you get one lobe of a prostate, which is perhaps a median lobe, affixed to the trigon, and in taking it out there is not a good prostatic nest left in which to put the bag.

I had one case like that. I put the Hagner bag in and he kept bleeding. We took the bag out and put a little piece of packing down in the wound and the bleeding immediately stopped. I think in that class of case, the bag is of no value.

Dr. HENRY H. MORTON (Brooklyn): I think there is an advantage in doing a preliminary vasectomy in these cases, not only on account of eliminating the chance of an epididymitis following the prostatectomy but also on account of the temporary stimulation of the accessory glands of the testicle which follows cutting off the vas, as shown by Steinach. There is, unquestionably, when this is done in these cases, a temporary stimulation of all the vital functions, which lasts from ten days to three weeks, but the stimulation comes just at the time when the patient is undergoing the prostatectomy and just when he needs all the vital force that he can have to carry him through the operation and convalescent period. So the vasectomy serves a double purpose in preventing the occurrence of epididymitis and giving a temporary lift to the lowered vitality.

Dr. FRANCIS R. HAGNER (Washington): I do not know what the incidence of epididymitis in prostatectomy is in our cases, but it is certainly very common, just as Dr. Randall said. I remember just one case that went on to suppuration. Usually, these cases get well pretty promptly. It is an unfortunate thing, but I do not believe it is a very severe complication.

There has been a good deal of discussion here today about the Hagner bag. I have had no experience with this instrument that the Doctor has brought out, but I think anything is better than gauze in these cases, and this may be a very good thing.

But the gentlemen who have discussed this matter today have talked about the difficulty in removing these bags. I think that is perfect foolishness. I can not understand how they can have any difficulty, if they will just follow the directions given them in the removal.

We deflate the bag in anywhere from six to twelve hours and let it remain in place for forty-eight hours. Then the part that is hanging out of the urethra is washed well in sterile water and soap, then bichloride, and then sterile water—a syringe is attached to the tube and the air sucked out so as to be sure it is closed. The suprapubic tube is removed and the portion of the tube that is hanging out of the urethra is soaked well with vaseline. The

tube is then pushed gently into the urethra, inserted just as a catheter would be, the tape attached to the top of the bag is drawn out through the suprapubic wound. Hardly one person in ten feels the removal of the bag at all, and I can not understand why they should have any pain. It is certainly much easier to remove the bag than to remove gauze.

Yet we have had one or two cases in our experience in which the bag could not control hemorrhage, just as Dr. Barringer mentioned. We have a little device for controlling the hemorrhage in those cases. We have a little gauze handkerchief made about that size (indicating), with a small opening that is stitched in the center, and that is slipped over the bag. We usually put the bag in. If we find it does not control the hemorrhage in these few cases, we remove it and slip this little handkerchief on the tube and pull it up over the bag; then that is drawn in and the bag is blown up, and the cause of the bleeding is always right down in the base; so if we will pack that little gauze down at that point, we will find the hemorrhage will be controlled. We have used this in two or three cases.

Dr. GEORGE R. LIVERMORE (Memphis): I think the question of hemorrhage in prostatic surgery is one of the most important we have to deal with.

It has been my experience that the Hagner or Pilcher bag answers the purpose admirably and I do not see any reason for making a change.

In regard to the pain, we have been using Gorthner's method of synergistic analgesia and have been gratified beyond measure with the relief of pain following any operation, and particularly in these cases where the bag has been used, the patients do not complain as they used to.

In removing the bag, I would add one feature that Dr. Hagner left off. Why drag that portion of the tube, which is beyond the meatus, all the way through the urethra and bladder? Why not cut it off close with the meatus and withdraw it?

In regard to Dr. Randall's paper, I, too, have had a large number of epididymitis cases following prostatectomy. I do

not know whether it is due to our shortcomings in operation or whether we have just been unfortunate in having the class of cases he cites, with the infection perhaps already in the vas.

In regard to Dr. Bugbee's remarks about preliminary massage, we often know that where we have infection in the vesicles and practice massage, it very frequently is followed by an epididymitis. Whether the massage has had anything to do with it or whether it is simply an extension of the infection, which would have occurred anyway, I do not know. We know it does occur.

I have never had the experience of massaging these cases that Dr. Bugbee has reported, but from past experience on other infections, it seems to me it would rather increase it. So I have made it a practice in recent times to ligate the vas as a preliminary step to a prostatectomy and it certainly does prevent epididymitis.

I had previously tried using the old Bellevue swing as a preventative and I can not say that that has had any influence whatsoever in reducing the number of cases of epididymitis.

Dr. HENRY G. BUGBEE (New York): I do not wish to be misunderstood. I did not mention the term "massage." I said, "gently stripping the vesicles;" that is, gentle pressure over the vesicles, just enough to express the contents with no vigorous manipulation. That is done after operation, while the patient is in bed.

Dr EDWARD L. KEYES (New York): I am enthusiastic about Dr. Townsend's sinker (not being a fly fisherman) because it illustrates the principle that very brief pressure will stop hemorrhage of the small vessels, arteries though they be, in and about the bladder neck.

Like Dr. Hagner, I think the bag stops bleeding almost universally. Like him, I use it. Unlike him, I believe that you do not need more than about fifteen or twenty minutes' pressure. Therefore, using the Hamer cage to hold the bag in, I put the machine on, with the patient on the operating table, and if we are doing two prostatectomies in succession I simply leave that patient in a corner of the room until I need the cage, finish the sec-

ond operation, take the pressure off, leave the bag in overnight, and take it out the following day.

An improvement on Dr. Hagner's handkerchief bag is to use a cigarette chain of considerable length to do your packing, and then pull the bag down on that.

Dr. W. W. Townsend (Burlington, Vt.): I have nothing to add except with regard to the criticism, which of course comes from the weight of this large bulb, the bulb was made heavy in order to retain the heat, which I believe has something to do with the hemostasis as well as the pressure produced by it.

Dr. Alexander Randall (Philadelphia): I think one of the most important things in regard to the epididymitis question is the answer as to when to do it. Dr. Bugbee's idea probably is excellent for the post-operative ones, but when six of our twenty-three cases occurred in the pre-operative period, I do not know that it is going to bring any great benefit to them.

Our figures certainly show that it has been a definite hindrance to prompt healing; the perineal cases being delayed almost double in this series and in our suprapubic cases, likewise, there is a definite delay in the time of healing in the cases with epididymitis.

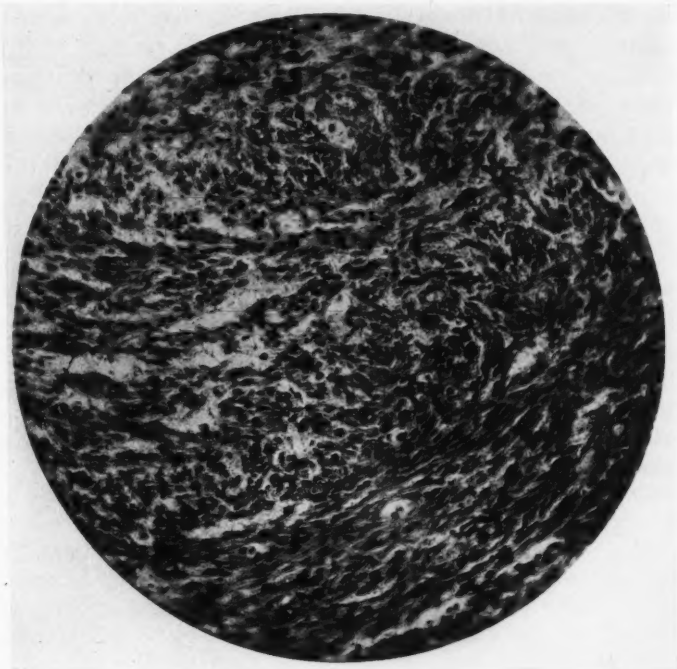
It would be interesting, I am sure, to any one to work out his own figures. I am more than ashamed of the high incidence I have found, but, nevertheless, it is like a good many things: when you begin looking for it you find a morbidity that you did not realize existed.

MYOSARCOMA OF THE PROSTATE CONTROLLED BY RADIUM

B. S. BARRINGER

New York City

This patient, aged fifty-four years, first came to the Memorial Hospital June 9, 1920, with a history of painful and frequent urination of six months duration. One month ago he noticed



fairly profuse hematuria. A suprapubic operation was performed, and a tumor shelled out of the right margin of his trigone. He was draining suprapubically when I first saw him. I opened

up his suprapubic sinus, and found a sloughy tumor, 2.5 by 2.5 cm. in diameter, situated over the right ureter and extending to the left ureter. Twenty-two bare tubes of radium, of 0.8 mc. and four of 0.28 mc. were imbedded in the tumor and a specimen removed. The bladder was drained. The pathological examination of the specimen removed showed myosarcoma probably prostatic in origin. Dr. Ewing made the examination.

In July, 1920, the right lobe of his prostate was slightly nodular, and in August the prostate was radiated with a steel needle placed through the perineum, 54 mc. for four hours. His prostate was radiated again in October, 1920, giving him 318 mc. hours, and in November, 1920, 480 mc. hours. In January, 1921, 208 mc. hours, and in April, 1921, 308 mc. hours. All this radium was given because of nodules in the prostate, which I believed to be malignant.

He was cystoscoped in January, 1922, and no definite tumor was made out. There was a little raised area above the right ureter, which was believed to be scar tissue. He has had a mild stricture, of his posterior urethra, from the radiation. This has been easily dilated, and today his prostate is smooth, slightly irregular, somewhat hard, suggesting fibrosis. He gets up at night to urinate two or three times, is in excellent physical shape and I believe his myosarcoma is definitely controlled.

It is six years within one month from the first time he came to us. This case is reported because it is one of the few I know of that has apparently been controlled by radium.

LEIOMYOMA OF THE PROSTATE

REPORT OF A CASE[1]

HENRY G. BUGBEE

New York

The following case was admitted to St. Luke's Hospital and came under the writer's care May 24, 1925.

The patient, a man forty-nine years of age, had complete retention of urine. His past history was negative. He complained of left sciatica of two months' duration. There were no urinary symptoms until two weeks before admission, when he began to have a poor stream and a tendency to dribble. There was no frequency or hematuria. On the day before admission he was unable to void and was catheterized.

The physical examination showed a well developed male, not acutely ill. The bladder was palpable at the level of the umbilicus. The prostate per rectum was symmetrically enlarged. The right lobe was softer than the left. There was slight induration over the left lobe.

He was catheterized, the catheter being retained in the urethra for the next seven days during which time his temperature ranged between 99 and 101 degrees. On the seventh day there was a distinct softening of the left lobe which was tender and gave the sensation of fluctuation. There was induration over the right lobe and base of the bladder. It was impossible to definitely map out the prostate.

In view of these rectal findings and the temperature, it was thought that a prostatic abscess had ruptured posteriorly burrowing upwards between the bladder and the rectum. An external urethrotomy was then done with the object of draining the abscess. Upon breaking through the prostatic capsule, a mass of soft friable material exuded. It was then appreciated that a tumor of the prostate—probably a sarcoma—had been encountered, and as much of this tissue as possible, about 12 ounces, was removed with sponge forceps, the tumor extending well beyond the reach of the finger, filling the pelvis between the bladder

and the rectum. The cavity was packed with gauze and perineal drainage established. The following day suprapubic drainage was substituted.

The patient was given roentgen-ray therapy at intervals over a period of four months. He immediately lost 30 pounds in weight, since which time his condition has slightly improved. The perineal wound has opened several times with a temporary leakage of urine. He has occasionally complained of painful defecation and perineal discomfort. During the past six months he has not lost in weight or strength. There are several soft masses palpable through the anterior rectal wall which seem to be getting smaller. Suprapubic drainage has been maintained.

The report on the tissue as given by Dr. Knox of the Pathological Laboratory of St. Luke's Hospital and confirmed by Drs. F. C. Wood and H. T. Brooks is as follows: "Specimen consists of masses of friable, yellowish and white tissue from the prostate. There is no capsule nor glandular tissue. On section the pieces are homogeneous, friable and cellular, with few yellowish caseous areas."

"Microscopical sections show no normal tissue but a tumor composed of smooth muscle, although it is possible that there is some connective tissue. The nuclei are very numerous in the better preserved portions, are elongated with blunt ends, and show mitosis only very infrequently. These stain rather deeply but are only moderately irregular and the tumor may be of low malignancy. There are many areas of necrosis and degeneration as the vascular supply is rather limited. There are also areas of calcification." Diagnosis: Leiomyoma of prostate."

Histologically this tumor of the prostate presents a picture of low malignancy if any, yet clinically it has the symptomatology of the most malignant of tumors—sarcoma.

In view of these facts I believe a diagnosis of malignant leiomyoma of the prostate can be made. An exhaustive review of the literature both through the Surgeon General's Catalogue Index, the Quarterly Cumulative Index, in Text Books on Tumors, Urology and Pathology, has revealed the report of 2 cases of leiomyoma of the prostate. Both were reported under the title of myoma.

The first case reported by Lebec (1) in 1876 was as follows:

The patient was a man, aged seventy-six, with a history of inability to urinate, who died of pneumonia. At necropsy, the bladder was

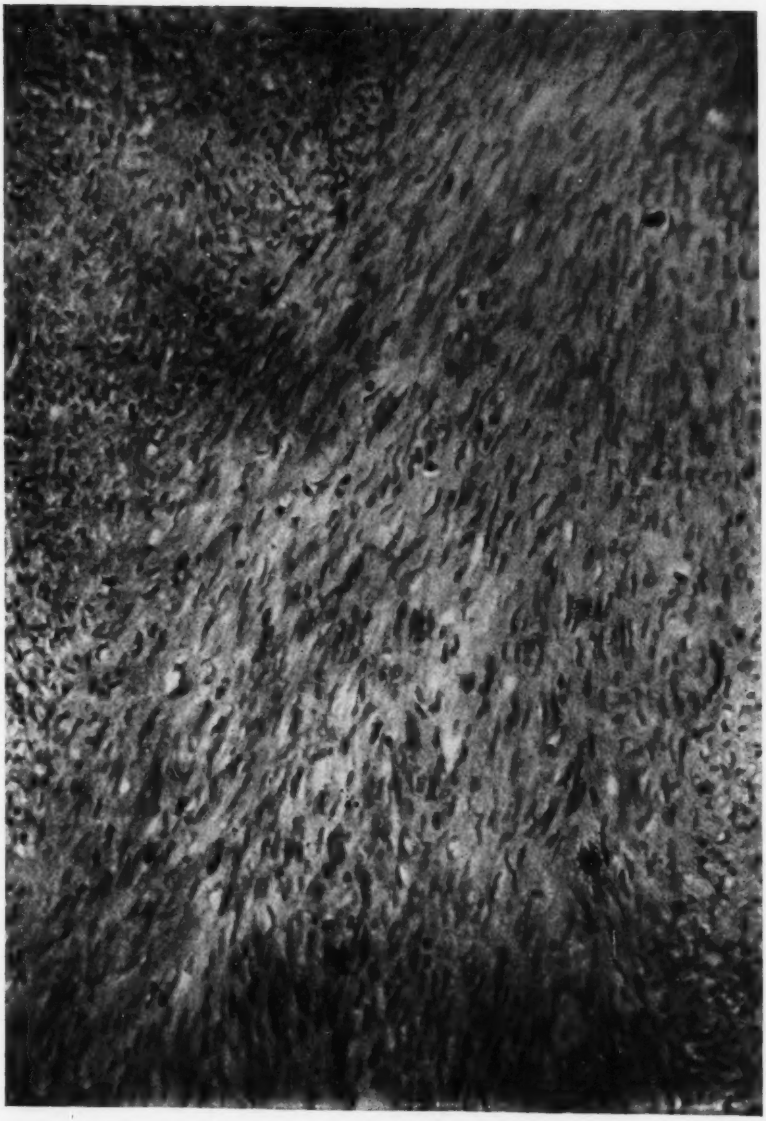


FIG. 1

found to be enormously distended. There was a tumor arising from the middle lobe of the prostate. The base of the tumor was limited posteriorly by the line joining the ureters; laterally, by the lines passing from these channels to the urethral orifice. A section made through the posterior portion of the prostate showed the tumor to be made up of two parts overlaid, the upper being the larger. The lower part of the tumor blended with the middle lobe of the prostate. *On microscopic section*, it was possible to definitely recognize *smooth muscle fibers in the tumor*, similar to the fibers of the uterus. Hence this was reported as a case of myoma of the prostate. [Although the term *leiomyoma* is not used in this article, the description clearly indicates that such was the nature of the tumor.]

The second case reported by Damski (2) in 1924 was as follows:

The patient was a man, aged sixty-two, who, at operation was found to have a large tumor of the prostate, of a very unusual nature. Clinically, however, there were no manifestations of prostatism. The specimen removed at operation disclosed a swelling of a grayish white color, the size of a child's head, and weighing 180 grams. Microscopic examination showed the tumor to be a pure myoma composed of smooth fibers. The entire mass of the tumor, as studied by sections through it in all directions, was found to be composed of smooth muscle fibers. [Two illustrations of microscopic sections. Although the term leiomyoma is not used, the tumor, from its description, was unquestionably such.]

Ewing (3) in the 2nd Edition of his book "Neoplastic Diseases" says:

Rarely, there is definite increase of smooth muscle cells in the prostate, usually in foci resembling small myomata.

Recent papers by Culver (4) and Bumpus (5) have reviewed the literature on sarcoma of the prostate and brought the total number of authentic cases to approximately 75, thus establishing the rarity of all tumors of the prostate other than carcinoma. In Culver's series (4) were rhabdomyosarcomas, or striped muscle tumors.

In these contributions above referred to, the difficulty of differentiating such a tumor from prostatic abscess is em-

phasized as well as the hopelessness of prognosis. Radium was employed by Bumpus in the cases he reported with an apparent retardation of the growth; and Young (6), in discussing his paper, reports the rapid disappearance of large sarcomas in 2 cases, both of which were alive and under control two years later.

Deep roentgen ray therapy was given in the cases reported by Bumpus and advised by Young. Had it been possible to make a pre-operative diagnosis in my case I would have employed radium; however, when the capsule of the prostate was opened one could but make an attempt to remove as much of the growth as possible and the roentgen ray therapy has definitely held the growth in check.

By having the possibility of these tumors ever in mind in dealing with any prostatic enlargement, especially in the man of middle age, it is possible that diagnoses will be made earlier, at a time when better results may be hoped for through radium and deep roentgen ray therapy.

REFERENCES

(1) Lebec: Myome de la prostate. Progress med., (June 17), 1876, iv, 471.
(2) Damski, A.: Grosses Prostatamyom ohne Erscheinungen des Prostatismus. Ztschr. f. Urol. Chir., (March 25), 1924, xvi, 47.
(3) Ewing, J.: Neoplastic Diseases. Second edition. W. B. Saunders Co., 1922, p. 779.
(4) Culver: Sarcoma of the prostate. Jour. Urol., xiv, no. 3.
(5) Bumpus: Radium and roentgen ray in the treatment of sarcoma of the prostate. Jour. Urol., xiv, no. 5.
(6) Young, H. H.: Jour. Urol. November, 1925, xiv, no. 5, 537.

POST-MORTEM REPORT OF CARCINOMA OF PROSTATE TREATED BY RADIUM

B. S. BARRINGER

New York City

This case is reported because it is in a way unique. It is the only case which I have been able to find in which a prostatic carcinoma, proved by specimen, has been entirely eradicated by radium.

The patient first came to the Memorial Hospital on November 28, 1916, with a history that six weeks previously Dr. Keyes had removed a prostate of which Dr. Ewing gave the following report:

> Four large sections of gland tissue were cut. Three of these show advanced interstitial growth of connective tissue and muscle cells. One area gives the structure of a miliary myoma. The glands are much disordered, and frequently subdivided by strands of stroma, and many small isolated alveoli appear. These portions may be regarded as atypical chronic inflammation. The fourth piece shows definite and marked overgrowth of small alveoli, with overnourished cells and with distinct cicatricial connective growth. This area must be regarded as adenocarcinoma.
>
> To consider the case as frankly carcinomatous would be an error; so also to dismiss it as simple inflammation. I believe it shows the beginnings of adenocarcinoma on chronic prostatitis.

The physical examination of the remains of the prostate showed some thickening and hardening of the median lobe, and some extension of the induration around the seminal vesicles. The median lobe of his prostate was treated with radium through his perineum, a steel needle of 51 mc. for eight hours, giving 408 millicurie hours. Within a month after this time he had complete retention of urine, and Dr. Keyes put in a suprapubic tube. On February 13, 1917, the left portion of his prostate was given a dose of 250 mc. hours, and the right lobe a similar dose, all

through the perineum. On November 17, 1917, there was a distinct thickening of the left vesicle. The tip of the examining finger could not reach the top of the indurated area. The left seminal vesicle was given a dose of 270 mc. hours, and the left prostate a similar dose. All this time he had his suprapubic tube.

In December, 1917, his condition was so good that I removed his suprapubic tube, together with a very large adherent calculus, and closed up his suprapubic wound. On June 4, 1918, he still had induration of the left prostate and left seminal vesicle, and was given a dose of radium of 312 mc. hours. On November 8, 1918, his prostate was still irregular, and probably carcinomatous. His suprapubic wound was tight; he urinated once or twice at night. On December 10, 1918, he was given another dose of radium. On January 28, 1920, there was a little thickening of the left seminal vesicle going to the left pelvis. Four bare tubes of radium, of 1 mc. each, were inserted into the left vesicle. On December, 1920, there was a band of induration passing from the right prostate to the pelvic wall, and a needle of 113 mc. was inserted for one and one-half hours.

He was treated by a radium needle in his prostate in July, 1921. This last dose of radium was too much for his heavily radiated tissues. I would have done better to have left him alone, for three months later, September, 1921, he developed a urethral rectal fistula. He got along fairly well with this, but in July 1922, a fairly large stone formed in the fistula. I removed this from the rectal end of the fistula without any trouble.

He came to the Hospital in July, 1924, suffering from painful and frequent urination, and very poor heart. At this time, he was seventy-four years of age. He had been fairly comfortable ever since the stone had been removed from his fistula, although suffering at times from frequent and painful urination. He was put to bed and treated for his heart, but slowly went down hill, and died November 4, 1924, eight years after his first radium treatment.

An autopsy was performed, with the following results:

The tissues in the region of the prostate show superficial ul-

ceration from marked arterioscleriosis and fibrosis. No trace of carcinoma. There were likewise no carcinomatous glands beyond the prostate. This case is reported in some detail, because to my mind it is of a great deal of importance. He undoubtedly had a carcinoma of low malignancy, and while the radium treatment prolonged his life but a few years, it proves the point which I have always maintained—that in a certain small percentage of cases, radium can control prostatic carcinoma.

The fistula formation was an unfortunate accident, and had it not been for this, he probably would have lived longer.

DISCUSSION

Dr. JOHN H. CUNNINGHAM (Boston): Because Dr. Barringer says it is so rare to find a prostatic carcinoma controlled by radium, I wish to add one other example. This patient was treated in Dr. Young's clinic some years ago. As to the amount of radium employed, I cannot say. The case was sent to me by Dr. Young when the patient came to Boston. He was under my care for some months when he developed a contracture at the vesicle neck, presumably from the action of the radium. I operated, relieving the obstruction through the perineum, and found the obstruction to be from very dense scar tissue. The patient subsequently died of metastasis, and I was able to recover the urinary tract.

The small amount of remaining prostatic tissue and the seminal vesicles were subjected to most careful investigation. They showed no evidence of carcinoma. The interpretation placed on the tissue by the pathologist was that the local carcinoma had been entirely eradicated.

Dr. FRANCIS R. HAGNER (Washington): I wish to report a case that I showed before the Society in Washington. You will probably remember a case of sarcoma of the kidney treated by deep x-ray therapy in which this large tumor absolutely disappeared. It was two years after the treatment when you saw him at Washington, at this time he was apparently in good health. He never had any local recurrence of the sarcoma of the kidney, but within a year from the time that you saw him he developed general sarcomatosis. He had it in the scalp, the brain, the mediastinum, and the chest, and he died about a year after he was seen by this Society.

Dr. B. S. BARRINGER (New York): Just two words: I do not consider Dr. Cunningham's case controlled. He died of metas-

tasis. When I used the word "controlled" I used it for the term "cured." I think we often eradicate the cancer from the prostate, but the patient dies of carcinoma, which is not controlling the disease.

Dr. CUNNINGHAM: Are there many local cures?

Dr. BARRINGER: I do not know how many are cured by radium. Perhaps Dr. Bumpus knows, although he has been very pessimistic in public and optimistic in private.

Just one word about the diagnosis, speaking of Dr. Bugbee's cases, of sarcoma of the prostate.

Dr. BUGBEE (New York): It was not sarcoma; it was myoma, smooth muscle tumor entirely.

Dr. BARRINGER: I was possibly thinking of Dr. Young's cases. I think the diagnosis should always be made without getting a specimen. The reason we got a specimen in our case was because it had been operated before, and we could not help going down suprapubically and seeing what was the matter. We ought to sacrifice our scientific desire for specimens for the welfare of the patient. I think the minute sarcoma of the prostate is cut into, that minute the patient is practically doomed. That has been shown time and again, and I think we ought to limit our scientific investigations to the physical examination.

We have had eight or ten cases at the Memorial Hospital. Two of them are alive today. The rest are all dead. One of them is an extremely interesting case in that the diagnosis was made without a specimen. He had a large suprapubic tumor, solid, and a large prostatic tumor. We were willing to diagnose it as sarcoma of the prostate because of the age of the patient and the large, smooth tumor. He was given deep x-ray therapy. I do not think he was given enough. I think cases like this should be given all the deep x-ray therapy and all the radium pack they can stand. We have an idea, at the Memorial, that radium pack added to the deep x-ray therapy gives greater security in these

cases, and, peculiarly enough, the skin will take a maximum dose of deep x-ray and a maximum dose of radium.

This case went along; the tumor went down, and for two years he was all right. Then he developed unmistakable metastases in his lungs. Those have been treated, and he is alive today, and I think that his metastases have gone. I think he will eventually die of sarcoma.

There is just one other point I want to touch on—the differential diagnosis of sarcoma of the prostate. If you have to make a differential diagnosis between sarcoma of the prostate and large abscess of the prostate, I would suggest a device which I have used at least once in these cases, that is, putting a needle through the perineum into the prostate. That causes a very small amount of trauma, and if you have pus, you will get it.

We had one case that we were sure had sarcoma of the prostate. We put through a needle and got a little pus, and found it was an abscess of the prostate.

Dr. HENRY G. BUGBEE (New York): I would just like to make clear that this was not a case of sarcoma of the prostate; it was myoma, a smooth muscle tumor. It did simulate sarcoma, but it was softer, I believe, than a sarcoma would be, and I do not know how it would be possible to make a differential diagnosis between a tumor of that sort and an abscess without an incision.

DISEASE OF THE URACHUS

REPORT OF TWO CASES

ALEXANDER RANDALL

Philadelphia, Pennsylvania

Disease of the urachus is sufficiently rare to permit me to report these two interesting cases: the first an abscess caused by an infection with Friedlander's bacillus, and the second an exceedingly rare incident of carcinoma of the urachus.

Case 1. H. G., Aged forty-one, white; occupation, clerk. Admitted to the hospital September 26, 1919.

Complaint. Swelling of lower abdomen.

Family history. Negative.

Past history. Patient had an attack of specific urethritis five months ago; was treated by a local physician and condition apparently cleared up without any complications: no history of any other serious illness or operations: urinary function has always been normal: patient denies alcoholism; is a moderate cigarette smoker; does not use drugs.

Present illness. Four or five days before admission patient first noticed a painful swelling in the midline of the lower abdomen below the umbilicus: since then patient has been increasingly indisposed, has had a fever, but no definite chill: has had some slight frequency of urination associated with terminal pain.

Physical examination. White male of rather slender muscular development: head is negative: pupils equal and respond to light and accommodation: lungs are clear throughout: heart is of normal outline and free of any pathological sounds. In the lower abdomen is found a large swelling situated between the symphysis pubis and the umbilicus: it is prominent to the eye and on touch is firm, rather fixed, round, smooth and tender, and is oblong in shape. It measures approximately 14 by 9 cm. the larger measurement in the longitudinal axis of the body. There is no evidence of any connection or attachment to the bladder and the mass feels larger than a distended bladder would. The

urine as voided by the patient contains shreds. Urinalysis: Reaction acid; specific gravity 1018; negative for albumin and sugar: microscopically shows clumps of pus cells. A stone searcher was passed and there was no obstruction in the urethra and no stone felt in the bladder. The bladder was lavaged and rapidly became clean. X-ray of the lower abdomen was negative for urinary calculus.

October 2, 1919. Cystoscopic examination revealed an area of peculiar bullous edema in the vertex of the bladder with a central area of increased hyperemia. In the actual center of this was seen a pencil of white material hanging into the bladder cavity, which was waving back and forth by the flow of irrigation fluid. It measured approximately 3.5 to 4 cm. in length by 6 or 7 mm. in diameter and appeared similar to a pencil of tooth paste being squeezed from its tube. On this finding a diagnosis of infected urachus was made.

October 6, 1919. Operation was performed under ether anesthesia, assisted by Dr. Lawhead. An attempt was made to free the abscess mass in toto without opening up the peritoneum with an idea of complete bloc excision. However, as is usual in such urachal lesions the walls were found to be exceedingly thin and their proximity to the peritoneum was intimate so that separation was impossible. I therefore contented myself with simple incision and drainage, packing the same tightly with iodoform gauze. Culture of the pus was subsequently reported from the laboratory as infected with Friedlander's bacillus.

The patient made an uneventful recovery except for an abscess in the scrotal wall which was opened and drained on November 21. Granulation of the large abscess cavity was slow and it was not until two months had passed that closure of the large drainage area had completely granulated. There was also a separation of the recti muscles and for this reason it was necessary to fit the patient with a proper lower abdominal belt to prevent an incisional hernia.

The patient was discharged as well on February 5, 1920.

Case 2. P. C., aged thirty-nine years, occupation, policeman.

Complaint. Pain at end of urination.

Family history. Unimportant.

Past History. Influenza in 1918: specific urethritis in 1921: specific primary sore in 1922.

Present illness. In August, 1924, ten months before admission patient had an operation for hemorrhoids since which time he claims not to have been free from pain. For three months this pain was located in

his stomach, unrelated to meals, dull and continuous. In October, 1924, he first noticed pain at the end of the urinary act, which became sharp and burning, and at the same time he developed frequency of urination, having to rise two or three times each night. There was a slight terminal hematuria at times, but frequently a terminal pyuria. His upper abdominal pain left and a suprapubic soreness developed which was increased at the end of urination and radiated down the urethra. The pyuria seems to have been intermittent and the hematuria at no time severe: the symptom of pain was improved when the pyuria was present. During the last few weeks the onset of urination has been difficult and the amount of urine passed scant. He has lost 10 pounds of weight during the past month. There have been no other local or subjective symptoms or signs.

Physical examination. The general physical examination presents nothing of interest or bearing on his local condition. Rectal examination reveals a small, firm prostate which is not tender. Above the prostate pressure causes an increase in his hypogastric pain. Following this examination the desire to void occurred and the patient passed 3 ounces of clear urine, followed by a small amount of pus. The end of the act was accompanied by an excruciating pain, which caused the patient to double up, and lasted for a period of a minute or more. Blood urea nitrogen, 37 mgm. per 100 cc. Blood pressure 112/52. Phenolsulphonephthalein appeared in six minutes; first hour 35 per cent; second hour, 30 per cent. Urinalysis: Reaction acid; specific gravity 1025: albumin trace: sugar none. Microscopic study shows an occasional hyalin cast, no red blood cells, 8 to 10 pus cells per field, and an occasional epithelial cell. Wassermann reaction was strongly positive; spinal fluid Wassermann negative; colloidal gold curve normal; cell count two lymphocytes only; globulin no increase; sugar markedly increased.

June 25, 1925. Cystoscopic examination. Instrument passed with ease; bladder found to contain no residual urine and a capacity of 4 ounces or more; bladder wall is covered with normal mucous membrane except in the fundus where is found a lesion situated in the neighborhood of 4 or more centimeters back of the interureteric bar. This lesion measures approximately 2.5 cm. in diameter: it is surrounded and bordered by healthy mucous membrane devoid of inflammatory reaction and appears as a shaggy brown mass bulging through a stretched and dilated orifice. The picture is one that suggests some extra-vesical body which is ulcerating its way into the bladder cavity.

Diagnosis. Two diagnoses were suggested: First, a degenerated gumma of the bladder wall; second, a foreign body. Bearing in mind the history of the patients having had an operation for hemorrhoids, and, as stated above, from which he dates the onset of his present complaint, it was thought possible that a sponge had been lost at that operation and was ulcerating its way into the bladder cavity. Efforts were made to obtain the details of this operation to determine whether or not it was a simple "clamp and cautery" procedure or a more extensive resection such as a Whitehead operation. These details could not be obtained. X-ray was taken of the bladder and slowed a rather circular shaped mass apparently extra-vesical and supporting innumerable trabeculi of calcareous character outlining the tumor mass.

June 28, 1925. Operation. Suprapubic incision was made under gas and ether anesthesia. As soon as the recti muscles were separated it was evident that the condition was one of urachal disease, an elongated tumor mass, the size of a child's fist, immediately being palpated. Realizing the close attachments of these tumors to the peritoneum, excision was started near its umbilical attachment; peritoneal cavity opened, the posterior bladder wall mobilized following the method of Voelker, and as soon as possible, the peritoneum freed from the posterior bladder surface and the peritoneal cavity closed. The mass was resected from the summit of the bladder with 1.5 cm. of healthy mucous membrane about its periphery. The bladder was closed about a large mushroom catheter as a drain, and the abdominal incision closed about this. Convalescence was satisfactory, although healing of the wound unusually slow.

July 24, 1925. A catheter was placed in the bladder per urethra, and only by sidetracking the urine by this means, was the bladder fistula healed by this method three days later.

The patient was discharged from the hospital August 21, he having been retained for a month in order to carry out deep-x-ray therapy following suprapubic closure.

Description of specimen. (*Dr. Bothe.*) The mass measures 9 by 5 by 3 cm. The surface is smooth and appears to be covered with a limiting membrane. At one or two points it is quite irregular and from one end oozes gelatinous material (apparently the intravesical area.) On section it was found to be fairly firm due to fibrous bands and in between these fibrous bands are large deposits of colloid material. There are also scattered deposits of a calcareous nature. Microscopic section shows considerable mucoid material, some fibrous tissue and free blood.

Scattered throughout are collections of epithelial cells, the general arrangement of which are glandular and these cells are large ranging from a cuboidal to a columnal type. The appearance of these cells is that of a malignant cell.

Diagnosis: Mucoid carcinoma.

June 18, 1926. Patient re-examined now one year since operation. Bladder cavity normal, scar pale and healthy. Has gained 15 pounds in weight, and is symptomless.

SARCOMA OF THE BLADDER

JOHN R. CAULK

Department of Urology, Washington University, St Louis, Missouri

Non-epithelial tumors of the bladder are as a group quite infrequently encountered; of these sarcoma is the most rare; hence the occasion for the report of the following case:

Mrs. V. Aged seventy-one. Entered Barnes Hospital, St. Louis, complaining of frequent, burning urination, with blood in urine.

Family history. Negative.

Past history. Sparkles with physical defects. Blind in left eye since childhood, due to an accident. Deaf in left ear since a young girl. She had the usual childhood diseases, severe malarial infection as a young woman followed later by typhoid fever. Menstruated at the age of twelve, periods always regular. At age of fifteen she was troubled with falling of the womb which required a pessary. Menopause came at the age of twenty-nine following which there has been no vaginal bleeding. She bore no children. Her life has been spent on a farm, devoted almost entirely to manual labor, plowing the fields and cutting wood. Eight years ago a St. Louis surgeon removed her left breast and glands of the axilla for a tumor which was diagnosed as sarcoma. Prior to this she had dripped blood from the nipple for two months. I consulted the surgeon and he informed me, as far as he could remember, it was round-cell sarcoma; he has been unable to send me sections of the growth. She has been free from cardio-respiratory symptoms. Her bowels, which were regular until about a year ago, have since been constipated and for some time she has suffered pain in the bladder region on evacuation of her bowels. For many years she has gotten up a couple of times at night to urinate. No other previous bladder complaints.

Present illness. Began three months ago with pain in the bladder region. Patient started to urinate and urine suddenly stopped; this was associated with lancinating pain reflected to the urethra. Since

then there has been intermittent spells of sudden stoppage on attempting to urinate associated with attacks of pain in the urethra. She has a continuous dull ache over the bladder region. Two months ago she started to pass blood in the urine; this has been practically constant, quite profuse, much worse during the last four days, so that at present she says she passes almost pure blood. Has lost slightly in weight and has become quite weak.

Present examination. Extremely weather-beaten old lady, very dark, wrinkled skin, otherwise fairly well preserved. Left breast is missing, no glandular enlargement of the axilla, heart and lungs negative, x-ray of chest and long bones negative. Several lipomata on the left arm.

General examination. Patient's general condition is fair, blood pressure—132, normal nitrogen, blood count—4,500,000. Considerable tenderness over the suprapubic region particularly to the left. An indefinite mass is palpable. No tenderness or enlargement in either kidney region.

Cystoscopic examination. Urine is very dirty and bloody, infected with colon bacillus. Cystoscope passes with extreme difficulty and is deflected markedly to the left, eye-piece has to be greatly depressed to enter. When it is in the bladder it is markedly fixed and well out with no excursion whatever. It was possible to put but very little water in the bladder and after repeated washings I was able to see that the bladder was encroached upon from its left wall by an enormous mass practically filling its cavity, the greater part of its surface being a dead-white-grey membrane which seemed perfectly smooth without any evidence of villous appearance or shaggy incrustation. This I felt sure was a large solid tumor of the bladder wall.

Gynecological Examination. Patient had been previously examined in the gynecological department with the following finding: External genitalia atrophic from senile changes, cervix small and flattened, fundus not felt but its position accompanied by mass about the size of a large lemon; shape of an acute anti-flexion of the uterus, firm, irregular, pressing against the bladder. At first they were of the opinion that the mass was pelvic, probably pressing upon the bladder. However, our examination led us to believe that it was bladder growth in that outside pressure had never produced such great intra-vesical bulging and extensions had never caused the type of necrosis which was seen in this instance. At the second examination the gynecologists felt that the mass was a bladder growth.

Operation. Suprapubic midline incision. On opening the abdominal wall an enormous mass was immediately felt occupying the pelvis particularly to the left which seemed as large as a small grapefruit. Peritoneum was opened, pelvic organs freed, uterus found to be atrophied

FIG. A

and not involved. The bladder was dissected free, peritoneum closed, bladder opened and an enormous tumor practically filling its cavity lying within its wall, as a walnut within its hull, presented itself. Tumor was friable, somewhat of a brownish chocolate color, lobulated, movable

within the cavity. On further opening of the bladder it was found to be attached by a pedicle, no larger than 1 cm. across, to the dome of the bladder a little to the left. Adjoining the pedicle of this tumor mesially was a round-slightly elevated button-like mass somewhat depressed in the center, much harder than the larger tumor, resembling an epithe-

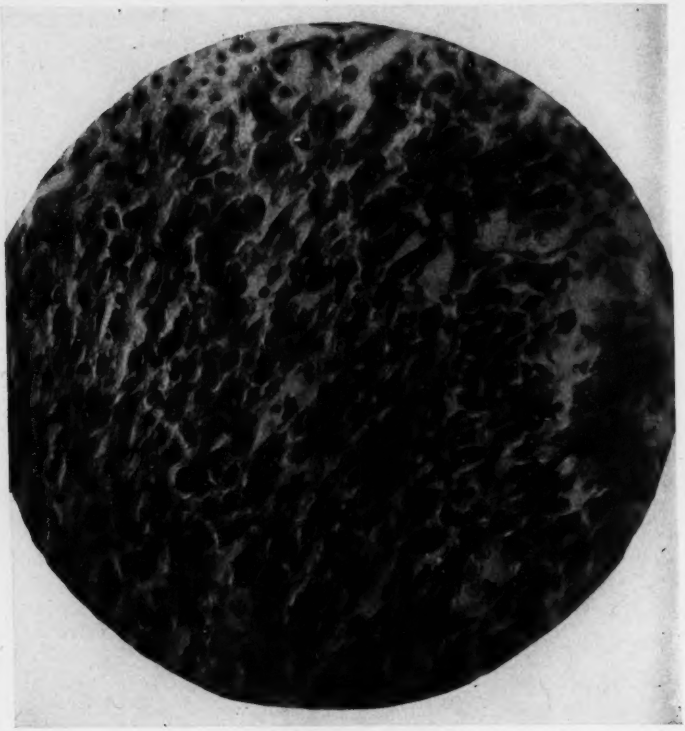


FIG. B

lioma of the lip about the size of a nickel. This was detected after the larger tumor had been removed by cauterization of its pedicle. The bladder wall with this smaller growth was then resected. The remaining bladder mucosa was perfectly clean and showed no signs of tumor. The larger growth hung by a short thin pedicle resembling an apple attached by its stem.

Recovery. Patient made an uneventful recovery, left the hospital in twenty days not completely healed.

Pathological report. Unfortunately the smaller tumor, which seemed to differ entirely in its structure from the larger growth, was lost in its transportation to the laboratory. This report concerns the larger growth, so that it is impossible to say whether this tumor was composed entirely of sarcomatous tissue or a mixed tumor. Sections of the larger tumor show: "The tumor is very cellular with large spindle cells predominating. There are a moderate number of large round cells many of which contain mitotic figures. A few large multinucleated cells were observed. There is little stroma and this is edematous in places. Capillaries were observed scattered throughout the sections. There is no evidence of necrosis. Diagnosis—large spindle cell sarcoma."

This indicates the primary nature of this bladder growth. Certainly without evidences of metastases and with an entirely different character of cell growth, the two neoplasms cannot be related.

Senftleben is accredited with the report of the first case in 1861; this was confirmed by Billroth in 1905. Wilder reported 50 cases collected from the literature. Fifteen years later McKenna collected 55 cases. The series corralled by Munwes brought the number to 107.

The comparative frequency of these tumors to other bladder neoplasms is indicated by the analyses of various students of this problem, for instance, Gardner encountered only 7 sarcomas in the 367 cases which he collected on whom operations had been performed by various urologists in the country. There were 52 sarcomas in Watson's list of 863 new growths of the bladder. Geraghty found 2 such growths in 180 tumors of the bladder at the Johns Hopkins Hospital. Felix Fuchs in 1926 reported 1 sarcoma in 136 bladder tumors. Scholl records a lone instance in the 262 growths which he studied at the Mayo Clinic. It is thus very evident that such growths are decidedly infrequent. In 303 tumors of the bladder which I have studied in my clinic at the Washington University, Barnes Hospital, and private practice the case which I am reporting today is the only sarcoma which has been clinically observed. Dr. H. A. Harris of the Department

FIG. 1

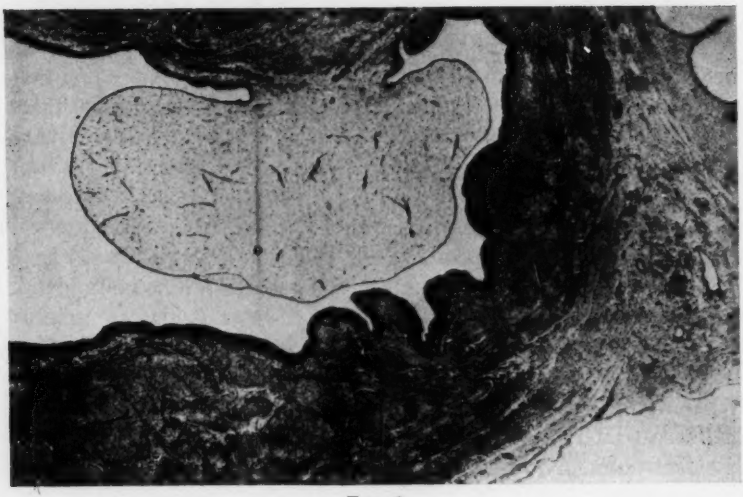


FIG. 2

of Anatomy of the Washington University reported and gave illustrations of a mesodermal tumor of the bladder occurring in a six months fetus. He has been kind enough to loan me his slides which show important embryological facts having a definite bearing on the development of vesical neoplasms, and I shall quote from his text quite closely.

Fig. 1. Shows rectum, vagina, and hypertrophied bladder wall with tumor of the trigone. (Note attempts at expression of tumor (foreign body) and hypertrophy of bladder wall.)

Fig. 2. Shows transverse section of the bladder and the tumor. The tumor is pedunculated and has the structure of a myxoma almost like Whartonian Jelly.

Fig. 3. Shows below the typical transition of epithelium of the bladder wall and above the single layered flat epithelium of the tumor.

Fig. 4. The Wolffian Duct joins the cloaca at the 4.5 mm. stage of the human embryo and the ureteric kidney bud appears dorsally on the Wolffian Duct near the entrance to the cloaca in the 5.0 mm. stage. The portion of the Wolffian Duct between the opening of the ureteric-kidney bud and the cloaca is taken up into the urogenital sinus and forms the so-called "cloacal horn" of the bladder.

Fig. 5. The absorption of this terminal piece of the Wolffian Duct into the wall of the bladder gives to the ureter its own direct opening into the bladder as seen in the 11 mm. stage. The trigonum vesicae is therefore of mesodermal origin as distinct from the rest of the bladder which is of entodermal cloacal origin. The trigone is formed by the expansion of the lower ends of the Wolffian Ducts.

Fig. 6. Shows transverse section through a foetal rabbit of 17.5 mm. The Wolffian Ducts are lined by columnar epithelium, the primitive bladder by transitional epithelium.

Fig. 7. Shows another section at a lower level where the lines of demarcation between the columnar and transitional epithelium are clearly seen. (N.B.: 4.5 mm. stage, fourth week; 5 mm. stage, fifth week; 11 mm. stage, end of sixth week.) The given tumor (refer to slide 3 again) is covered by a single-layered epithelium which is formed from the distention of the columnar epithelium of the Wolffian Ducts and not by metaplasia of the transitional epithelium of the bladder wall. The change from columnar epithelium to single-layered epithelium is common in polypi of the nose and cervix uteri, in cysts of the thyroid, and elsewhere, but metaplasia of a transitional epithelium has not been described.

Sarcomata of the bladder are very rare and they are localized entirely to the trigonum vesicae. The limitation of sacromata to the trigone

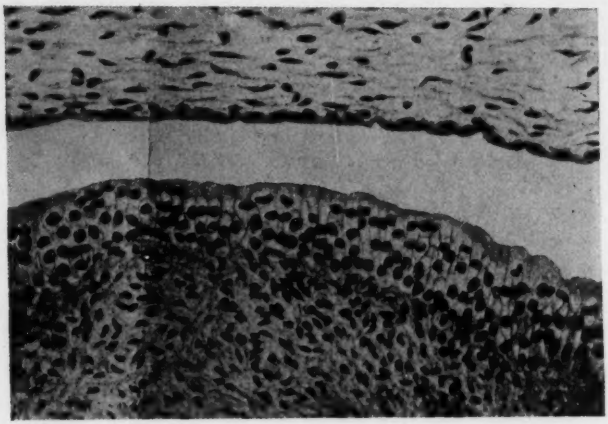


FIG. 3

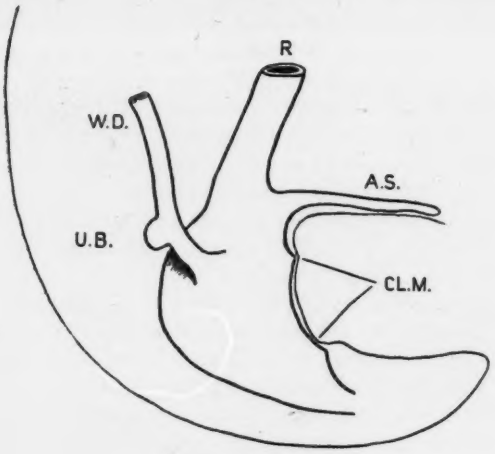


FIG. 4

of the bladder thus confirms that view of the development of the bladder which ascribed to the trigone a purely mesodermal origin from

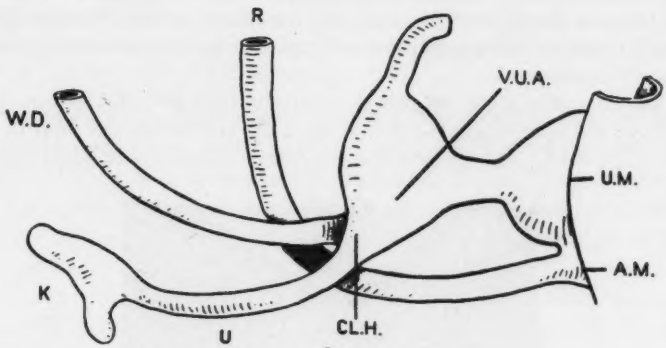


FIG. 5

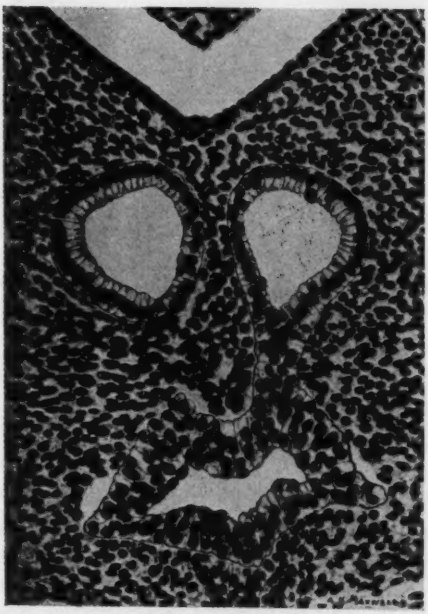


FIG. 6

the expanded lower ends of the Wolffian Ducts. The tumor is a defect in "tissue-combination" between the mesoderm of the Wolffian Duct and entoderm of the primitive cloaca and may be classified as a dysontogenetic hamartoma.

The allantois is an outgrowth from the hind-gut of the primitive embryo and is incorporated first of all in the body stalk and later in the umbilical cord. In the cord the allantois presents spindle-like dilata-

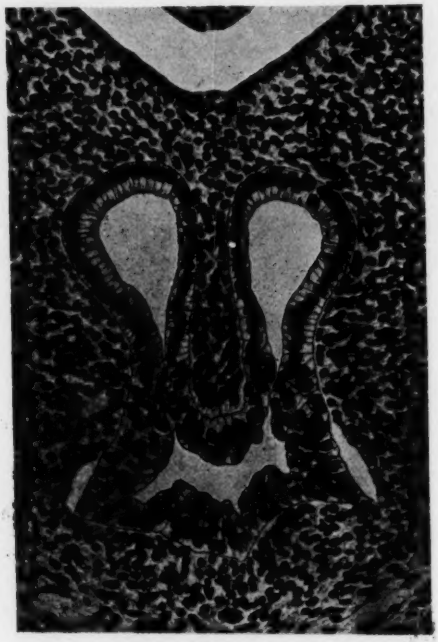


FIG. 7

tions. The intra abdominal portion of the allantois in a well differentiated embryo is called the urachus. The allantois and urachus cannot give rise to a sarcomatous tumor of themselves but the mesoderm of the body stalk which is continuous with the mesoderm of the umbilical cord may give rise to a myxoma closely resembling the Whartonian Jelly of the umbilical cord. The so-called cases of sarcoma of the urachus have been mixed tumors. The epithelial cystic element coming from

one of the dilatations of the allantois, or urachus, and the myxomatous ground tissue from the primitive mesoderm. The only case in which the sarcomatous element proponderated was that described by Alban Doran in The Lancet (1909, vol. 1, p. 1304).

Analyses of the cases which have been reported in the literature indicates the great selectivity of sarcomatous tumors of the bladder to the trigone and at its juncture with the bladder base in all probability having a great deal to do with the faulty seam of fusion of the two fetal surfaces and the mesodermal origin of the trigone.

The growths may be sessile or pedunculated. Most authors agree on the predominance of the sessile variety, but Kauffmann's experience is to the contrary. Ewing believes that these tumors produce a large double polypoid intra-vesical growth or diffusely invade the bladder wall. These tumors are characterized by great rapidity of growth and pronounced tendency to extra-vesical extension particularly in the region of the symphisis. Dr. Cecil of Dallas recently showed me a case of sarcoma of the bladder with marked extension of the symphisis upon which he did a total cystectomy.

The large size of these tumors often confuses them with pelvic growths. The case I am reporting was at first believed to be a fibroid of the uterus. These tumors are usually soft and friable, frequently cauliflower in appearance, usually single, though multiple tumors have been described. Ulceration is rare.

Various types have been described, namely, vascular, myxo-sarcoma (Kauffmann), myo-sarcoma, round-celled-sarcoma, spindle-celled sarcoma, lympho-sarcoma (Chaffey), fibro-sarcoma, osteo-chondro-sarcoma (Beneke and Fisher), and angioma-sarcoma (Jungano).

Mixed tumors of connective tissue and epithelial origin have also been described notably by Albarran, Lenormont, Gussenbauer, and others. Lenormont describes an epithelio-sarcoma and refers to Gussenbauer's observation of a myo-sarco-carcinoma. Billroth also removed a myo-sarco-carcinoma; Albarran describes an adeno-sarcoma which he removed from a boy. Verhoogen has also reported cases of this nature. There is a uniform agree-

ment among these authors that such growths are of embryonal origin from allantoid remnants; they all occur at the dome, and that attention was first called to this by Albarran. These clinical observations substantiate the embryological facts above described.

It may be that the case I am reporting was of this mixed type since grossly the two parts of the tumor presented an entirely different appearance, the larger being much softer, lobulated and devoid of definite architecture, whereas the small growth definitely resembled an epithelioma of the lip, it was a mere elevated button on the bladder wall approximating the pedicle of the larger tumor, and on gross-section it presented a typical appearance of carcinoma. Very unfortunately it was lost in being transferred to the laboratory and no histological section was made.

There is nothing in the symptomatology of such tumors to distinguish them from other bladder neoplasms with the exception there is a tendency for them to appear early in life although they may be observed at any age and hemorrhage is often more profuse and obstructive symptoms more likely. Oneill in 1915 in his article on tumors of the young found the majority to occur under 5 years of age; they were connective tissue tumors and mostly malignant. Deming's observation coincides. In Albarran's 51 cases there were 7 in the first decade.

Cystoscopically many of these tumors have been indistinguishable from epithelial growths. I was confident in my patient that the tumor was not a carcinoma on account of its enormous size and the smoothness of its surface, and although necrotic, it presented none of the sloughing, shaggy, irregular surface with lime salts deposits as is so frequently seen in the infiltrating epithelial growths.

All methods applicable to vesical tumor growths have been applied to the treatment of these tumors, cystectomy, partial and complete, intra-vesical excision by knife and cautery, implantation of radium and x-ray therapy, and diathermy, have all been utilized with no particular advantage in any one method but with the discouraging feature of a high immediate mortality.

Early metastases were observed by Munwes in 50 per cent of necropsied cases. Years ago Albarran called attention to the rapid spread of metastases, particularly to the lungs. Early therapy is therefore absolutely essential.

Albarran reports death in 50 per cent as a result of operation.

Watson reports death in 63 per cent of collected cases, patients died immediately after operation.

Munwes reports death in 55 per cent of collected cases who died shortly after operation, or 38 of 59, only 3 patients were cured for five years.

Wilders reports death in 1 case of 50, patient lived one year after operation.

Mixter reports death of a child three and a half years old who remained well for two years.

My patient died in four months of pneumonia.

REFERENCES

CIRILLO: Jour. Urol., xviii, 1924.
LOWEN, CHAS.: Colo. Med., xx, 1923.
WILDER: Amer. Jour. Med. Sci., 1905.
MCKENNA: Surg. Clincs of Chicago, 1920.
SCHOLL: Surg., Gynecol. and Obstet., xxxiv, 1922.
LOWER, WM. E.: Ann. Surg., 1922.
BARRINGER: Surg., Gynecol. and Obstet., 1920.
BEER: Ann. Surg., 1921.
SMITH: Canadian Med. Jour. July, 1925.
JAMIESON: Med. Jour. and Record, 1925.
FUCHS, FELIX: Zeit. fur Urol. Chir., xvii, 1925.
DEMING: Surg. Gynecol. and Obstet., xxxix, 1925.
LENORMONT: Jour. de Urol., xiv, 1922.
HARRIS, H. A.: Jour. Anat., vol. 60, April, 1926, Dept. Anat. Washington Univ. Med. School.
IVES, GEO: Path. University Club Bldg., St. Louis, Mo.

PAPILLARY ADENOMA OF THE KIDNEY

JAMES PEDERSEN

New York, N. Y.

Whether malignant or benign, adenoma of the kidney is sufficiently infrequent, apparently, to warrant the report of any single occurrence.

It occurs as a diffuse involvement of the organ or as a well-outlined, encapsulated growth. Of the two pathologic forms—the alveolar and the papillary, the papillary is said by Stengel and Fox for example, strongly to resemble carcinoma and sometimes to behave like it. Others say that the transition from papillary adenoma to papillary adeno-carcinoma is not a sharp one (Cunningham) and that the only difference between the malignant and the benign adenoma is the fact that one develops metastases while the other does not (Cabot). Histologically they are identical. The specimen in hand was finally reported as a simple benign papillary adenoma, without any trace of malignancy. It is seen to be well encapsulated.

The patient, an able bodied man, seventy-one years old, without previous kidney or bladder symptoms, suddenly noticed blood in the urine. This recurred off and on during the two weeks before he came to us.

From the left kidney the urine was normal and the functional test also. From the right kidney the urine was scanty and contained blood; the functional test low or deficient. Neither colon nor tubercle bacilli were found; but the laboratory commented on the "unusual desquamation of small, round epithelial cells."

The pyelogram on the affected side showed a suggestive filling defect in the lower calices. The principal diagnostic point was an outward deflection of the lower pole of the kidney. This was due to the extension of the tumor mass against the vertebral column.

The kidney was removed through an oblique lumbar incision. The capsule of the growth was ruptured in the removal and some of the fri-

able, hemorrhagic fluid contents were spilled. This will account for the breaking down of a part of the wound, nevertheless the patient left the hospital at the end of the third week.

For comparison with the foregoing, I add a case of papillary epithelioma of the kidney in the practice of my associate, Dr. Morrissey. As seen in the plate of the pyelogram, the growth acted as ball-valve in the lower part of the kidney pelvis, causing a filling defect there and impeding the outflow of the solution. It was necessary to make a double pyelogram, as the patient complained of symptoms in the left side while the cystoscope showed that the hematuria came from the right kidney. The kidney was successfully removed and the patient made a normal recovery.

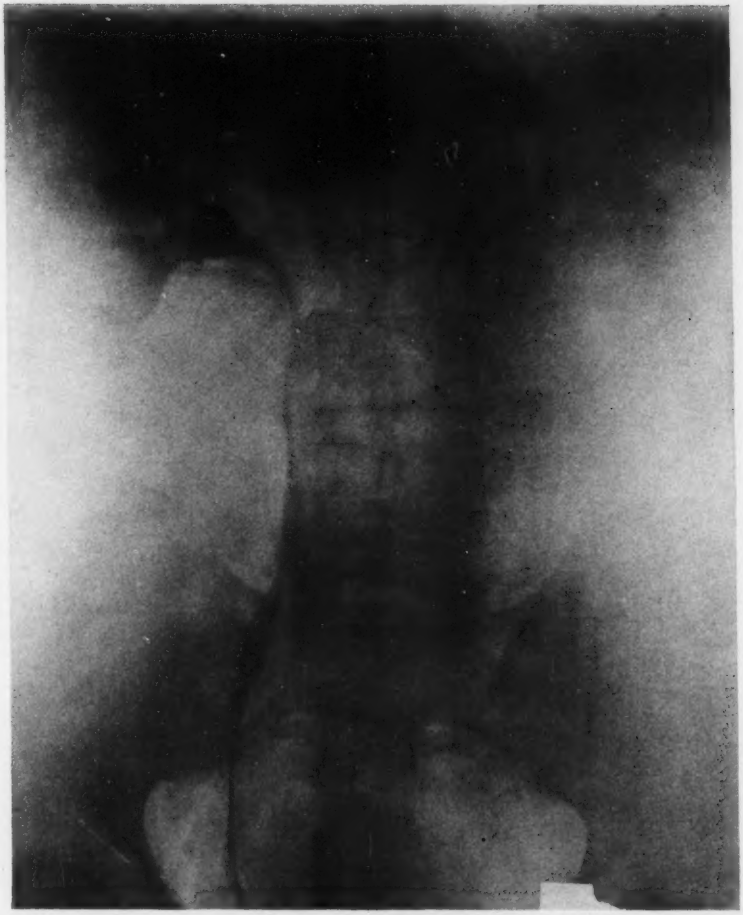


FIG. 1. PYELOGRAM OF PAPILLARY ADENOMA OF THE KIDNEY

Note the relatively normal pyelogram and the manner in which the lower pole of the pyelogram is tilted outward from the ureter. Note distance between ureter and pelvis shadow.

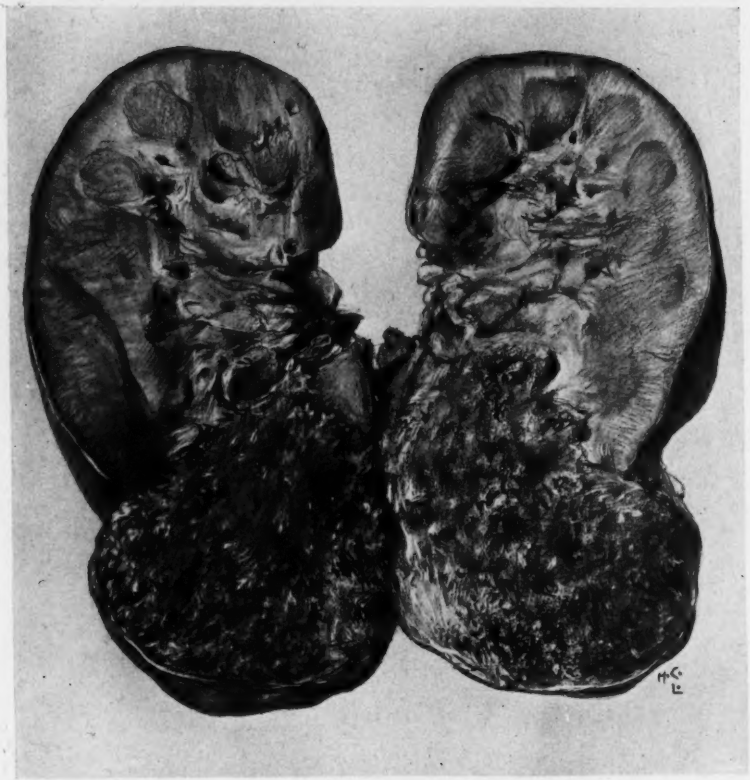


FIG. 2. DRAWING OF KIDNEY REMOVED SHOWING PAPILLARY ADENOMA OF THE ENTIRE LOWER HALF OF THE KIDNEY

Note the papilliform character of new growth; its relative consistency and the general lack of appearance usually noted in malignant new growths.

FIG. 3. PYELOGRAM OF PAPILLARY EPITHELIOMA

Note definite filling defect in lower portion of pelvis and moderate hydronephrosis above.

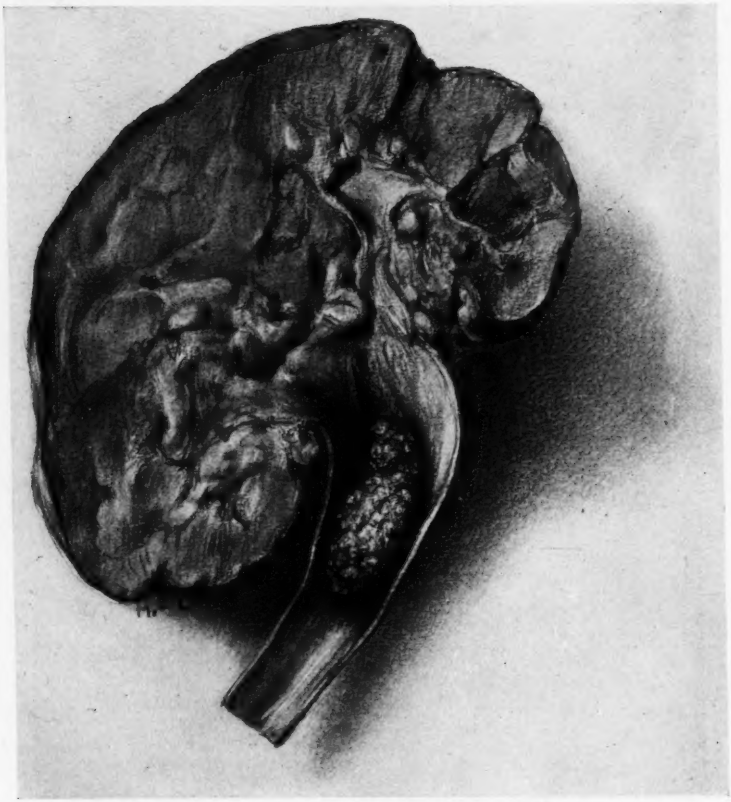


FIG. 4. DRAWING OF SPECIMEN OF WHICH FIG. 3 IS THE PYELOGRAM

THE RAPIDITY OF GROWTH OF MALIGNANT TUMORS OF THE BLADDER

JOHN H. CUNNINGHAM

Boston, Massachusetts

This communication is based upon observations made in connection with two patients who were cystoscoped for certain reasons, and who at the first examination showed nothing suggesting a tumor of the bladder, and who at subsequent cystoscopic examinations, with the elapse of but short periods of time, showed malignant tumors of considerable size. These two observations, proving how rapidly malignant tumors of the bladder may develop, seem of sufficient interest to record at this time, as other instances may be recalled to the minds of the members of this society, and additional data upon this point may become available.

The rapidity of development of malignant tumors of the bladder is, of course, variable. Whatever ideas we have had in this connection have been based largely upon the duration of symptoms. Mackenzie (1), in his report before this Association last year in recording a series of 228 patients, of which 118 had malignant tumor, estimated that 75 per cent had hematuria as the chief symptom, and that relief was sought on this account in varying periods of time from two weeks to thirty years after the onset of the initial symptom. He expressed the belief that many of the patients with the long duration of symptoms had originally papillomata, which underwent malignant change.

Bugbee (2) in reporting a series of 19 patients with malignant tumors of the bladder before this Association in 1922 stated hematuria as the chief symptom, and the shortest period seeking relief after the initial symptom to be two weeks. The longest elapsed time after the initial symptoms was two years. His patient with the symptoms of two weeks duration had a malig-

nant papilloma at the fundus of the bladder, and the one seeking relief two years after the initial symptom proved to have a diffuse infiltrating carcinoma of the base and neck of the bladder.

In looking over our records of malignant tumors of the bladder for the past year, which number 31, we find the shortest period of duration of symptoms to be the first patient here reported, and the longest to be three years.

All this data is similar to other information in regard to the subject. There is little or no evidence available, however, which gives an idea of how long it may take the tumors to be developed to the point of giving symptoms. My two observations in this connection are here recorded.

The first observation was made on a young adult male, thirty-eight years of age, who gave a history of falling and striking the right lumbar region. This injury did not incapacitate him. On the following day there developed marked soreness and a black and blue area of considerable size over the right kidney region; frequency of urination, occurring about every hour, and the urine contained bright blood. There was pain in the right kidney region radiating downward into the right groin, not severe in character, but constant. The pain disappeared in the course of a few days, but the increased frequency, with the presence of bloody urine, continued.

At the time that we saw him (October 23, 1925) which was eight weeks following the injury, he complained of frequency of urination on an average of six times during the day, and twice at night, and an indefinite pain in the bladder region. The hematuria had practically subsided, there being only an occasional small amount of blood mixed with the urine.

The general examination was negative except for the urinary tract. Tenderness, without spasm, was present in the right kidney region and over the whole right side of the abdomen. Neither kidney could be felt. The external genitals were negative. The patient voided 8 ounces of urine, which was cloudy, specific gravity 1005, normally acid; large trace of albumin, no other abnormal chemical elements, and the sediment consisted of much blood, many white and numerous epithelial cells.

Cystoscopic examination showed no residual urine: much bladder spasm, and the musculature slightly increased. The left ureteral opening and that side of the trigone were normal. The region of the

right ureter was very edematous, and acutely inflamed. The orifice could not be seen on account of this condition. There was nothing in this area, however, that suggested new growth. No attempt was made to pass a catheter to the kidney because of the active inflammatory process about the orifice.

An x-ray examination showed nothing abnormal in the urinary tract. It was noted that there was an extra rib, which of course has no bearing on the acute complaint.

The patient was advised to take large amounts of water and 10 gr. of hexamethylemine 4 times a day. Daily bladder lavage, for the purpose of diminishing the inflammation in the bladder, so that the study of the upper urinary tract could be made, was advised. Bladder lavage so improved the symptoms during the following two weeks that the patient became irregular in his visits.

On December 14, 1925, seven weeks after the first cystoscopy, the second cystoscopy was done. The capacity of the bladder was larger than at the previous examination, and there was less irritability. The important feature is that in the region of the right ureter orifice, previously noted as edematous and inflamed, there was a distinct sessile tumor about the size of a large grape. This tumor had grown directly over the right ureteral orifice, so that the orifice could not be visualized.

Our interpretation of the bladder condition on October 23, 1925, the first cystoscopic examination, was that he had an inflammatory reaction about the right ureteral orifice, probably dependent upon renal infection following a kidney injury, and the discovery of the new growth was a great surprise.

On January 2, 1926, approximately nine weeks after we first cystoscoped the patient and found no tumor, a suprapubic cystostomy was done. Situated over the right ureteral orifice was an infiltrating tumor, sessile in character, the size of a horse-chestnut, the lower border of which extended to within 1 cm. of the vesical sphincter. The tumor was excised for histology, and the area subjected to controlled diathermy. The patient made an uneventful recovery. The pathological report is as follows: "Microscopic examination shows multiple layers of epithelium surrounding slender connective tissue stems. Mitotic figures are readily found. Tumor is infiltrating base of specimen. Diagnosis: Malignant infiltrating papilloma of bladder."

The second observation was in a male patient, forty-five years of age, who was cystoscoped for a frequent and painful urination, dependent

upon a cystitis, and slight bilateral renal infection, March 4, 1925, and which condition subsided by appropriate treatment in a period of about ten weeks. Six months later he developed a slight painless hematuria, without previous symptoms.

Cystoscopy, September 6, 1925, showed an infiltrating sessile malignant growth, the base of which was somewhat larger than a silver dollar, located in the region of the left ureteral orifice, and obscuring it. A suprapubic cystotomy was done; a specimen taken for examination, and the area treated by controlled diathermy. The specimen removed at operation proved to be an actively growing carcinoma of the infiltrating type. The patient made an uneventful recovery.

Nowhere in the literature have I been able to find any observations of similar instances, and these two examples show how rapidly a tumor of the bladder of high malignancy may develop and attain a considerable size.

REFERENCES

(1) MACKENZIE: Trans. Amer. Assoc. Genito-Urinary Surg., 1925, xviii, 215.
(2) BUGBEE: Trans. Amer. Assoc. Genito-Urinary Surg., 1922, xv, 394.

DISCUSSION

Dr. RICHARD F. O'NEIL (Boston): I should like to report a recent observation which bears on Dr. Cunningham's presentation as to the rapidity of growth of bladder neoplasm.

I saw a patient a few months ago with a history of hematuria and bladder symptoms for some time. Cystoscopy showed an elevated area, with sharply defined edges, at the fundus of the bladder. The whole growth could be readily gotten in one field of the cystoscope. So I estimated that it was about the size of a quarter.

The patient came to operation about four weeks later, and to my great surprise the growth in that short time was several times the size that we made out on examination. So that in this particular case, in which the diagnosis was carcinoma, the growth had been very rapid within a few weeks. It certainly shows the necessity of operating on these cases as early as possible after diagnosis.

Dr. B. S. BARRINGER (New York): I should like to say a word on the value of the cystogram to supplement to the cystoscopic examination. I have become a great disbeliever in my ability to diagnose the extent of a tumor of the bladder by cystoscopic examination. I think if we take an air cystogram we get an idea of the size of the tumor, because I think that when we cystoscope a patient we may think he has a very small tumor and cystogram shows he has an enormous tumor. I have frequently tripped up in that way and I think the cystogram helps us out.

Dr. Cunningham's presentation was extremely interesting. I have an idea that we have all slipped in exactly the same way, but I have an idea if he had taken a specimen of the area he saw at the first time, if it had suggested a tumor, the specimen would have shown a malignant growth of the bladder.

Dr. ARTHUR L. CHUTE (Boston): In regard to Dr. Cunningham's paper, I think there is a good deal of evidence slowly accumulating that points to the fact that these growths begin intramurally.

I mentioned in a paper read in Dallas last month two cases that I believe are very suggestive. In one instance, I went over carefully the bladder of a man who had had vague urinary symptoms for some time, and found nothing. I cannot give the exact time, but within a relatively short time after, his bladder showed a considerable amount of carcinoma. Other instances of this sort have come under my notice; it is possible that I may have overlooked an obvious condition, but on the other hand I was looking for something to account for the patient's symptoms.

My opinion is, particularly from the autopsy findings in certain cases of carcinoma of the bladder, that the carcinoma, sometimes at least, begins intramurally and then extends to the surface. In patients on whom I have transplanted the ureters preliminary to doing a total cystectomy, it has *not* been unusual to find a hydroureter or even a hydronephrosis when the growth gave no surface evidence of involving the region of the ureter. In these cases it has seemed to me that the growth has mushroomed within the bladder wall and involved the ureters and even strangled them when, so far as surface indications went, it appeared to be some distance away.

I suspect that a lot of unusual surface changes that we see in bladders may represent the earliest surface manifestation of a deep-lying carcinoma. I do not see how we can prove this as yet, but I believe it is probably so.

Dr. HENRY G. BUGBEE (New York): I would like to briefly mention a case, one of a series of cases that Dr. Cunningham mentioned in his paper, that I reported some four years ago.

This woman had a growth which on the surface of the bladder showed an elevation which was not more than 1.5 or 2 cm. in diameter. We did a resection of the bladder, apparently well around the growth, having a centimeter of apparently healthy tissue all around the growth, but the microscopic sections showed

carcinoma extending along the muscle bundles to the cut edge. We inserted radium needles around the lines of resection, and that patient has been followed and cystoscoped every six months up to the present time.

Until about six months ago, the bladder was clear. About six months ago, a slight elevation appeared at the margin of the former scar. This was watched, and increased very slightly in size. It was not more than a centimeter or a centimeter and a half in diameter. However, I again opened the bladder and did another resection, removing about a third of the bladder, and although there was only about a centimeter and a half of growth on the surface of the bladder, intramurally there was a growth the size of a silver dollar.

It shows how misleading it is to depend upon the surface appearance in the bladder. I believe, as Dr. Chute has just said, that many of the growths are really intramural growths.

Dr. HENRY H. MORTON (Brooklyn): I would like to say, in connection with the rarity of growths occurring anywhere except in the trigone that I do not think I have ever seen a growth occurring in the dome until last fall. Then a man came to me with an ulcerating carcinoma in the fundus which was plainly to be seen with the cystoscope.

I operated on him and found that the growth had developed originally from the urachus and had infiltrated the entire posterior portion of the bladder down to the base and interureteral region. It was impossible to remove it entirely, and after excising a large portion of the infiltrated bladder wall a certain amount of carcinoma was left.

Permanent drainage through a suprapubic catheter was established and maintained during the remainder of his life.

He lived several months after the operation in a fair degree of comfort.

But the particular point of interest in the case is the fact of the carcinoma beginning in the urachus and located in the upper portion of the bladder.

Dr. JOHN R. CAULK (St. Louis): Dr. Keyes was kind enough to call my attention to a misstatement I made: that the fusion which I was talking about was responsible for the sarcomatous growths in this neighborhood, not epithelial.

Dr. JOHN H. CUNNINGHAM (Boston): I rather expected that somebody would say that these tumors were in the bladder when I first cystoscoped the patient and that I did not recognize them. (Laughter.) I was prepared to say that even if they were, it does not at all take away from the fact that the growths developed extremely rapidly, one in about two months and one in about six months.

Third Day May 12, 1926

THE SYMPTOM OF FREQUENT URINATION AND ITS ETIOLOGY

A. J. CROWELL

The Crowell Clinic of Urology and Dermatology, Charlotte, North Carolina

Frequency of urination is a manifestation of some pathological condition. Cystitis is a term often used to designate the disease when it is only a symptom, just as fever is a symptom of some infection. Frequency of urination accompanied by pyuria may mean inflammation of the bladder only, or the source of the infection may be in the kidney. If the infection is limited to the bladder, the symptoms readily subside under proper local treatment; but if the infection is in the kidney, the bladder manifestations will continue until the renal infection has been obliterated.

Aside from the urinary frequency seen in nephritis, diabetes, and in certain neurotic individuals, I wish to confine my remarks largely to pathological conditions of the genito-urinary tract, manifesting themselves in frequency of urination. Nephritis and diabetes are conditions to be taken care of by the internist and the neurotic cases by the neurologist. Both conditions have pathology, but out of the domain of the urologist.

No one should be satisfied to diagnose a case as cystitis when there is only increased frequency of urination, and especially if there is no pus, or practically none in the urine, without first having made a careful investigation to ascertain the etiology of such frequency. Frequency is one of the earliest manifestations of kidney tuberculosis.

Mechanical obstruction to the urine's outflow may produce marked frequency when no pus or blood is found in the urine, or, at least, in only small amounts. One certainly should not be satisfied to make such a diagnosis when these symptoms have

persisted for a considerable length of time, and more especially if the frequency is accompanied with definite pain in a given location. Kinks of the ureter, as well as ureteral stricture, will offer resistance to the outflow of urine, cause pain and increased frequency. Ureteral obstruction, partial or complete, acute or chronic, results in kidney pain and increased frequency.

FIG. 1. LEFT URETERO-PYELOGRAM SHOWING DEFORMITY AND DISPLACEMENT OF THE URETER DUE TO EXTRINSIC CAUSES; IN THIS CASE A TRACTION DEFORMITY DUE TO ADHESIONS AND ABERRANT VESSEL

Partial urinary obstruction with dilatation of pelvis and calyces. (Catheter in situ.)

Frequency of urination is always marked in acute inflammatory conditions of the urinary tract, and especially when located in its lower portion. Frequency without pain is often due to hypertrophy of the prostate in the male and cystocele in the female. Until such time as infection occurs, in both these conditions, there is no pain or other manifestations of infection.

These introductory remarks are made to emphasize the importance of a careful investigation into every case of undue

frequency of urination. It is only by an accurate knowledge of its etiology that intelligent remedial agents can be instituted in any disease.

Acute inflammatory conditions of the urethra produce undue frequency and are easily diagnosed, but the frequency produced by chronic obstruction of the urethra is often overlooked and

FIG. 2. SAME AS FIGURE 1, EXCEPT THAT THE INJECTION WAS MADE BY WAY OF A LARGE TAPERED CATHETER WHOSE TIP WAS JUST WITHIN URETERAL ORIFICE

Same findings as in figure 1

especially in stricture of large caliber. Stricture of the urethra in women, producing bladder irritability, is much more often overlooked than it is in men.

In chronic atonic seminal vesiculitis, undue frequency during the day is a prominent symptom. It is painless and the urine is usually free from pus. If associated with prostatitis or verumontanitis, the frequency is both day and night, and is accom-

panied with pain in proportion to the *acuteness* and *character* of the infection.

Bladder stone symptoms are similar to those of chronic seminal vesiculitis, in that, the frequency is more marked during the day, but unlike it in that the frequency is increased by motion. Motion does not markedly increase the frequency in seminal vesiculitis.

FIG. 3 LEFT URETERO-PYELOGRAM ONE MONTH AFTER URETEROLYSIS OPERATION SHOWING NOW A STRAIGHTENED URETER AND REDUCTION IN SIZE OF PREVIOUSLY DILATED PELVIS

Carcinoma of the prostate causes undue frequency, but in an entirely different way from that caused by adenomations hypertrophy. In the former, the bladder usually empties itself fairly well and certainly in its early stages, but in the latter the frequency is caused by the bladder's inability to completely empty itself. In the beginning both have a negative urine.

Frequency of urination when accompanied by hematuria is very significant. If acute and painful, and especially if terminal.

it indicates inflammation in the posterior urethra or bladder. If chronic and painless, suspect new growth in the bladder, ureter, or kidney pelvis.

Tuberculosis of the kidney, chronic nephritis, or nephrolithiasis will cause undue frequency. Stone in the bladder is a chronic condition and may produce blood in the urine, but until the bladder becomes infected, about the only symptom is in-

FIG. 4 RADIOGRAPH TAKEN SIX MINUTES AFTER THE ONE IN FIGURE 3 SHOWING A GOOD EMPTYING TIME OF KIDNEY PELVIS—A MORE COMPLETE EMPTYING IN A SHORTER PERIOD OF TIME THAN AT THE ENTRANCE EXAMINATION

creased frequency of urination which is more marked during the day.

The frequency due to ureteral obstruction should be divided into two types: extrinsic and intrinsic. The extrinsic are those which interfere, by pressure, with the outflow of urine from the kidney into the bladder. Bladder stone or bladder tumor, abdominal or pelvic tumor, pregnancy, uterine displacements, inflammatory conditions of the seminal vesicles, ureteral kink,

ptosed kidney, or aberrant vessels are the principal conditions in this class of cases, manifesting themselves in undue frequency. Any of these extrinsic conditions are predisposing causes to infection and when it occurs, the frequency is greatly increased. Each of you know how often infection occurs in pregnancy, and with what difficulty it is controlled.

The intrinsic obstructions are those located within the ureter, such as ureteral stone, tumor mass, or stricture. Stricture or narrowing of the ureter may be due to edema—which is only temporary—or it may be fibrous and permanent. The intrinsic obstructions, as a rule, cause greater concern and are more difficult to treat. However, whether the cause be intrinsic or extrinsic, the end result is urinary stasis, increased frequency of urination, kidney infection, and impairment of its function.

I shall dwell somewhat at length on ureteral obstruction because it is hard, at times, to ascertain definitely the cause of the bladder irritability when a careful investigation will reveal urinary stasis, as a result of ureteral obstruction, either extrinsic or intrinsic. The tendency is to stop our investigations—in cases of undue frequency—as soon as we receive a negative urinary report from the laboratory, and diagnose the condition as hysteria, neuro, or neurasthenia. This certainly is true if on cystoscopic examination the findings are negative, regardless of other definite symptoms, such as pain in a given location.

The normal kidney pelvis and ureter empties itself in three to five minutes and when it fails to do so a careful investigation will reveal its cause. With ureteral obstruction, more or less hydronephrosis will result and usually in proportion to the degree of obstruction, and its chronicity. This, however, is not invariable for we may have stasis with but little hydronephrosis, and yet interval pyelograms will show urinary stasis. The ureteral catheter should be removed immediately after injecting neo-silvol—or whatever fluid is used for the uretero-pyelogram—and a picture taken at once to ascertain if we are dealing with a normal or abnormal ureter and pelvis. These should be taken at intervals thereafter until the pelvis and ureters have completely emptied themselves of the pyelographic fluid. The

degree of stasis and its severity is manifested by the length of time it takes the pelvis and ureters to empty themselves, rather than by the amount of hydronephrosis. Such investigations are very important in cases of chronic bladder irritability. I could show you slides illustrating various degrees of ureteral obstructions, manifesting themselves in delayed emptying time, but I do not feel justified in monopolizing your time by so doing, since such results are so natural and obvious that it is unnecessary to appeal to the eye. In acute ureteral obstructions, causing bladder irritability the diagnosis is easy, as a rule. Ureteral stone impaction is associated with frequency of urination and certainly if the stone is located in the lower ureter. The diagnosis of the condition is made by ureteral catheter and radiography. Stricture and new growths in the ureter are slower in onset, but manifest themselves by frequency of urination and are diagnosed by means of the uretero-pyelogram and emptying time. I am still unreconciled to the method of diagnosing ureteral stricture by means of the bulb, bougie, or catheter. The uretero-pyelogram, frequently repeated, is the proper method.

To illustrate the value of repeated investigations, in cases of undue frequency of urination with definite pain in a given location, I wish to show you a few slides and briefly report a case.

This patient is sixty-two years old, the mother of four children, and always healthy until her present affliction. Following a hysterectomy for fibroid eight years ago she began suffering with undue frequency of urination. Two years later she underwent an operation for adhesions at which time the appendix was removed. This was followed by ventral hernia for which a third operation was performed with no relief from her urinary symptoms. She then fell into our hands, complaining of great frequency of urination with definite and constant pain in her left back and inguinal region. Urinalysis and Wasserman were negative. No special tenderness on deep percussion over either kidney.

Cystoscopy showed a normal bladder mucosa and the ureters were normal in location and appearance. Her ureters were catheterized without difficulty and the phthalein output and differential specific gravity were good and equal from each kidney.

We reported to her physician that from a urological standpoint our findings were negative.

Like bad money, however, she came back and we investigated her condition more carefully. Her urine was still negative but a ureteropyelogram showed a displaced and kinked ureter. This we corrected, as I will illustrate by means of slides, and we cured our patient.

In closing, I want to insist that undue frequency of urination signifies pathology (when not produced by undue fluid intake) and that we should not be satisfied to cease our investigations until we have used every means at our command to ascertain the cause of this symptom. The neurologist will be of incalculable value in working out the pathology when not found by the urologist or internist. Successful treatment of any condition is impossible without an accurate knowledge of the etiology and pathology back of the symptoms.

"ESSENTIAL" HEMATURIA

NATHANIEL P. RATHBUN

From the Urological Service of the Brooklyn Hospital, Brooklyn, New York

The term "essential hematuria" has been used for many years with the more or less frank understanding that it was a confession of ignorance and has been applied to all cases of unilateral renal bleeding in which we were unable to determine the underlying pathology. Most of the earlier writers made the error of attempting a solution of the problem by presupposing that all unexplained cases of bleeding must fall in one group. A definite step forward was taken when we began to approach the problem with the idea in mind that these cases might fall into one of several groups, many of them well understood. A more careful study of many of these cases, including a careful follow-up, has resulted in a relatively simple diagnosis in many cases. For example some of them have proven to be very early and relatively slow-growing tumors, which evaded a diagnosis by all means at our command in the early stage, particularly before the days when pyelography was employed as a routine diagnostic measure. Others have proven to be cases with small calculi not opaque to the x-ray. In others we have been able to demonstrate pyelitis, ureteritis, ureter stricture; neoplasm of the ureter, some constitutional dyscrasia and so on through a long line of definitely well understood pathological lesions. As a result of more careful study the number of cases of unexplained renal bleeding has been gradually narrowing and the term "essential hematuria" is seen much less frequently in the literature. There still remain, however, a number of cases which do not appear after the most careful and painstaking investigation to fall within any of the well known groups. It is to this relatively small group that I wish to direct your attention. There is a disposition, I believe, on the part of some urologists to

satisfy their diagnostic conscience by calling some of these cases unilateral nephritis, some even going so far as to assume that while this has a unilateral expression in the beginning, that it was part of a general condition which would eventually involve the other kidney. This of course may be true and if so is a very important point to appreciate since it would modify materially any consideration of surgical attack. It has not seemed to me that these cases conform either in local findings or systemic manifestations to my understanding of nephritis. None of the cases which I have studied and followed have at any time presented any of the systemic phenomena usually associated with all of the various types of nephritis; the kidneys involved have always measured up well with the various functional tests and tubular casts, except for occasional blood casts noted during the period of active bleeding have been a very unusual finding.

I have for a number of years mentally associated some of this group of cases with another illy defined and poorly understood group of cases which Fenwick discussed many years ago as the chronic aching kidney. Perhaps this attitude has confused the situation in my mind but it has seemed to me that certain cases in these groups have overlapped since, while the converse is not true it is a fact, in my experience that all bleeding kidneys ache. As a result of this attitude I have allowed myself to indulge in a certain amount of speculation as to a type of pathology which might produce the symptoms of aching and bleeding. I realize, of course, that speculation without a fundamental base to build on is very apt to lead one astray, since we might begin with nothing and conclude with less. I have, however, supplemented my speculation with certain clinical observations and pathological data which would seem to lend a certain amount of credence to my views. Of course the scarcity of pathological data accounts in a measure for a certain amount of the mystery that surrounds these cases. They practically never come to autopsy, rarely to operation and even less rarely to any form of radical operation, which would provide the best opportunity for careful histological study. Moreover most or many of these cases that have been subjected to nephrectomy have been

operated upon during a period of active bleeding or perhaps as a life saving measure undertaken for secondary hemorrhage following a previous nephrotomy—under these circumstances the picture is much confused.

In a paper read at the New York Academy of Medicine on April 20, 1921, and published in The New York Medical Journal of November 2, 1921, I said in part as follows.

> I believe that there are certain pathological lesions which occur in the kidney which present a fairly definite group of clinical phenomena and which are usually spoken of as nephritis for want of a better term, that are not nephritis at all, at least not as we ordinarily interpret the term nephritis. I further believe that these lesions, in at least some of these cases, represent the scar of a previous inflammatory condition caused by remote forms of infection and that these lesions may occur as a localized process confined to part of the kidney tissue, or as a diffuse process involving the entire renal stroma and indirectly involving the blood vessels, glomeruli and tubules.
>
> Clinically these cases present themselves in two groups which in my opinion definitely overlap. These groups are first, the cases of so-called idiopathic hematuria, about which there has been so much in the literature of the last twenty years; and second the chronic aching kidney, which is rather vaguely mentioned in some of the older text-books but of which little has been written in recent years. When I say that these groups overlap I ought to go further and say that, in my opinion, they are all one. In my experience, all bleeding kidneys at some time or another ache; and while not all of the aching kidneys that I have seen have presented the symptom of hematuria, I feel, that if followed over a sufficiently long period of time, that many of them would.

This paper was not very cordially received, most of the discussion was adverse and the published paper attracted very little if any attention. Perhaps this is the exact amount of attention to which it was entitled. Nevertheless, I have continued to entertain these views and still feel that they are worthy of consideration and discussion.

It is a well known fact that many kidneys become the seat of a more or less violently acute inflammatory process which we recognize as pyelitis or pyelo-nephritis and which respond more

or less quickly to well recognized methods of treatment. I am perfectly satisfied that many of these cases in times gone by and to a less extent even at the present time, are never properly diagnosed. This applies particularly to the cases occurring in infancy and early childhood. Many of these unrecognized cases have undoubtedly gone on to a complete recovery from their acute symptoms and while in a certain number a chronic form of pyelitis, pyelo-nephritis and pyelo-ureteritis with pus and bacteria still in the urine may persist over a period of years, there are still a large group of cases in which the forces of nature have been able to entirely overcome the infection and nothing is found in the urine to indicate a past or present inflammatory reaction. It seems fair to assume, in fact I believe it may be stated as an established fact that in certain instances, particularly those cases which are very acute or of relatively long standing, the inflammatory reaction extends beyond the mucous membrane and involves the submucosa in its pathological and histological changes. Is it not fair to further assume that this process would pursue the usual changes of inflammatory reaction in other organs—round cell infiltration, fibrosis and scar tissue?

Let it be assumed for the sake of presenting my argument that this type of pathology constitutes one group which we may think of as the diffusely scarred kidney.

There is another group of acute renal infections also reasonably well understood. I refer to the cases of cortical abscesses, many of which were subjected to more or less indiscriminate nephrectomy ten years ago, most of which are now treated by incision and drainage with resulting renal conservation. Again I think it is fair to assume that some of these cases go on to spontaneous recovery by means of the abscess or abscesses rupturing into a neighboring calyx or the renal pelvis. If this does occur, what becomes of the abscess cavity? It is unreasonable to assume that there is an entire rejuvenation of renal tissue with normal renal architecture. I believe the cavity is replaced by scar tissue and here we have the kidney with one or more local areas of scarring.

There is a third group, rather more speculative and perhaps more entertaining. These are the infarcts which may occur from remote foci of infection, which do not go on to suppuration but which do bring about histological changes; tissue degeneration, round cell infiltration, fibrosis and scar tissue. One might well ask: even granting such pathological conditions, why should those kidneys bleed? It seems to me that this might be brought about in at least one of two ways; (1) as a result of the well known tendency of scar tissue to contract; circulation through some of the small venules might be impeded with resulting varicosities and eventual rupture. (2) As a result of impaired circulation there might well occur degenerative changes in the vessel walls themselves again with resulting leakage.

I realize, as I said at the outset of this paper, that speculation per se not only proves nothing but is hardly worthy of consideration unless supported by at least a modicum of clinical or more especially pathological data. For obvious reasons it is evident that no one observer will ever have available any large amount of pathological material for the study of this question. I have been fortunate in having secured a certain amount of pathological data which have seemed to lend some might to my views and have at least encouraged me in my continued speculation. From a small group of cases I should like to present a synopsis of the history and findings in three which at least have a bearing on the subject under consideration. The first two cases are quoted in part from my paper of 1921.

Case 1. M. F., aged forty-five, widow, was admitted to my service at The Brooklyn Hospital on December 15, 1919, with the following urological history: For the past seven years she has had a dull aching pain in the left loin which occasionally radiates to the left groin. During the past year she had three attacks of profuse hematuria which in each instance were traced to the left kidney. For the past three months the pain in the left loin has been much worse and has been severe enough to confine her to her home most of the time and to her bed part of the time. A cystoscopic examination made on July 12, 1919, about a week after one of her attacks of hematuria, presented the following findings: There was a stricture of the urethra which was readily dilated;

except for a mild congestion of the trigone the bladder was normal; there was a slight edema about the left ureter orifice; catheters passed readily to the kidney pelvis on either side; phenol sulphone phthaline output was normal and equal on the two sides; the urine from each side was normal, free from abnormal elements and sterile; urea right 16.48; left 16.23; guinea pig inoculation was negative; the Wassermann was negative and the blood chemistry was normal.

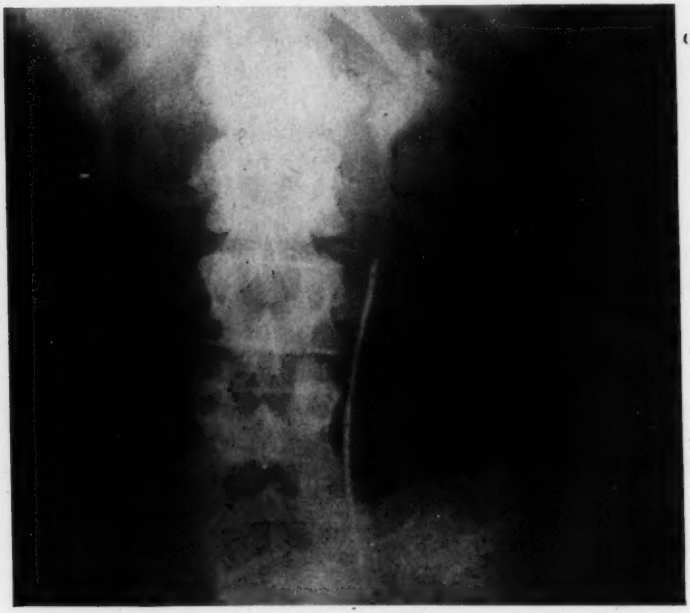


FIG. 1. PYELOGRAM OF CASE 1

Note irregular filling defect in calices. Pyelogram is somewhat similar to the cases of atrophic pyelo-nephritis described by Braasch.

Cystoscopy was repeated on December 17, 1919, and the findings were identical with those of the first examination except that a few pus cells were noted in the urine from the left kidney. Cultures, however, were sterile. The x-ray showed some enlargement of the kidney. The pyelogram showed a somewhat irregular, distorted kidney pelvis (fig. 1). (I might note in passing that in practically all of my cases of bleeding

kidney I have noted some irregularity of the pyelogram, most of them strikingly similar to this case and having also certain resemblances to a group of cases described by Braasch under the heading of "atrophic pyelo-nephritis.") Exploratory operation was decided upon and performed December 23, 1919. The kidney was somewhat enlarged, the contour somewhat irregular. The surface had a somewhat lumpy appearance due to a number of small cysts which can be seen and fall directly under the capsule. The kidney was split, and on section there

FIG. 2. KIDNEY REMOVED FROM CASE 1

Note numerous small cysts. Many of these areas were removed for microscopic study. Note also thickening and fibrosis of pelvic wall.

were noted, scattered throughout the kidney a number of cavities varying in size from that of a pin head to that of a large pea. Rightly or wrongly, nephrectomy was decided upon and performed (fig. 2). Unfortunately it so happens that our laboratory personnel was somewhat disarranged at that time and sections were rather casually examined and reported a moderately advanced vascular and glomerular nephritis. One year later the paraffine blocks were resurrected and subjected to more careful study. Following is the pathological report: "This kidney

examined in 1919 and reported as early chronic interstitial nephritis. New blocks cut from paraffine embedding for more comprehensive sections. There were two sections of the kidney which reconstruct a considerable portion of the cortex and medulla. The capsule was wanting as it had been stripped off. The general topography of the

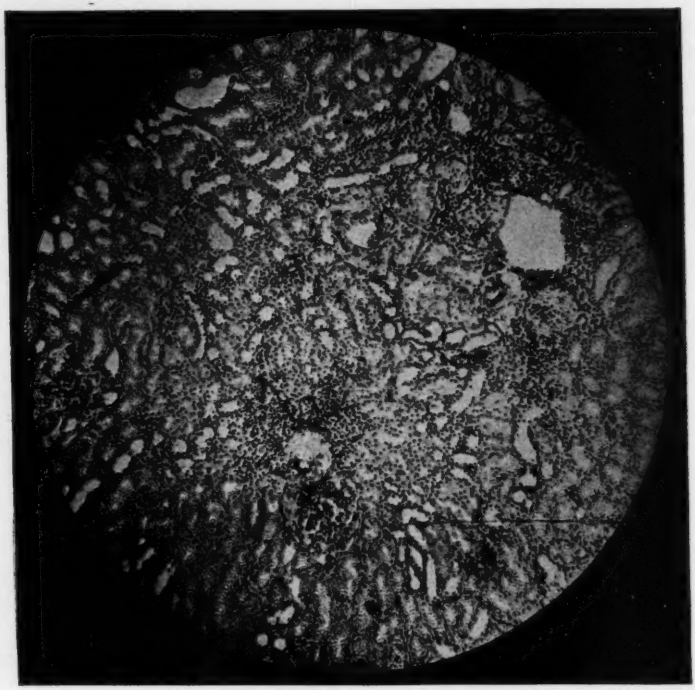


FIG. 3. SECTION FROM KIDNEY SHOWN IN FIGURE 2
Appearance very similar to that noted in ordinary diffuse nephritis

kidney was not greatly altered although small areas of connective tissue formation about the blood vessels were quite striking as well as several small cysts, one or two of which were filled with blood. In the cortex, scarred glomeruli and some enlarged glomeruli with thickened capsules, thickened smaller vessels and small islands of lymphocytes with a small amount of fibrosis were the chief lesions. There were some degenerated

tubules and dilated tubules containing hyaline casts. Passing toward the pelvis, the fibrosis becomes somewhat more marked, the vascular lesions were the same and the tubules somewhat less degenerative. The lining of the pelvis shows a little thickening but no inflammatory reaction was present. The whole appearance of this kidney, gross and

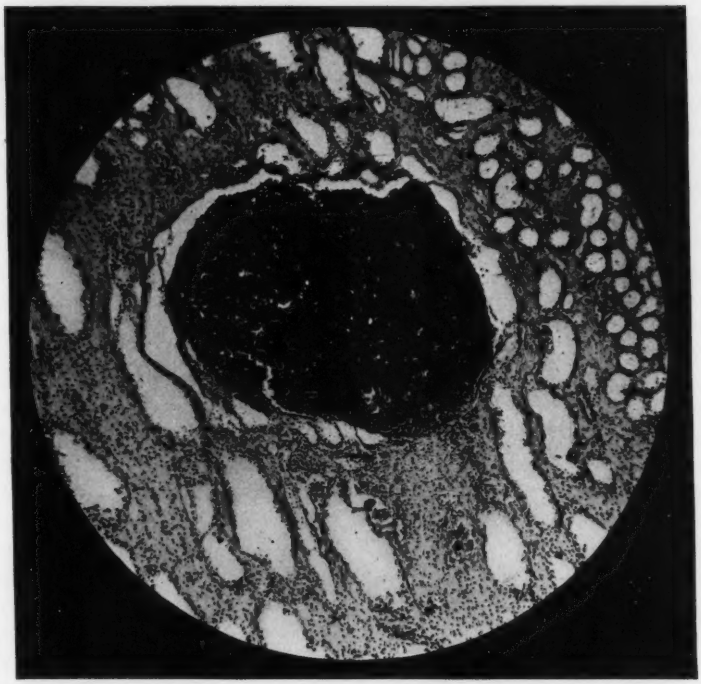


FIG. 4. ANOTHER SECTION OF KIDNEY SHOWN IN FIGURE 2, SHOWING RECENT HEMORRHAGE

microscopic, suggests a vascular and glomerular type of nephritis, when the cause is not known. Considerable functionally active kidney still remains" (figs. 3 and 4).

While of course we must pay due deference to the final pathological diagnosis, I am free to confess that this specimen does not conform to my conception of an ordinary nephritis. It is obviously an advanced

lesion which should show some disturbance in its functional capacity. It is certainly not an early or prenephritic condition. Is it unreasonable to assume that such a condition might have been caused by a diffuse

FIG. 5. PYELOGRAM OF CASE 2, SHOWING APPARENT FILLING DEFECT
This corresponded to hard area noted at operation

inflammation of the kidney stroma, call it what you will, chronic cellulitis of the kidney, perhaps with a secondary involvement of the tubules and glomeruli. It is interesting to note that this case has been

carefully followed to date, that she has remained perfectly well and that repeated examinations of the urine have failed to show any involvement of the remaining kidney.

Case 2. W. E., female, aged thirty-five, married, admitted to the Brooklyn Hospital December 13, 1917, with the following history:

Beginning three years ago, for a period of one year she had been troubled with slight bladder irritability and was obliged to urinate once or twice at night. Two years ago she had a profuse hematuria, lasting four days, accompanied the last two days by severe colicy pain referred along the course of the left ureter and caused no doubt by the passage of clots. I saw her at this time and was able to demonstrate cystoscopically that there was blood coming from the left kidney. Following this attack she was restored to perfect health except for a dull aching pain which was referred to her left loin and which remained fairly constant up to the time of her admission. Oddly enough, following the hematuria, her bladder irritability entirely disappeared. The day of admission she again passed very bloody urine. Cystoscopy on December 14 showed a blood clot protruding from the left ureteral orifice, urine from that side was very bloody, while the urine from the right kidney was normal. She was kept in bed with no other treatment than light diet and forced fluids and the bleeding promptly subsided. Cystoscopy was repeated on December 20. At that time the urine was clear, the bladder and ureteral orifice normal. Intra-muscular phthaline was excreted in good concentration from the right kidney in eight minutes, from the left kidney in nine minutes. The urine from each side was free from all abnormal elements and was sterile. The x-ray showed a slight enlargement of the left kidney and the pyelogram showed an apparent filling defect between the upper and middle calices (fig. 5). A provisional diagnosis was made of renal tumor and nephrectomy was proposed and accepted. At operation, when the kidney was was delivered upon the loin, it appeared perfectly normal except for moderate enlargement. The kidney was split and an area about 1 inch in diameter was noted near the middle of the kidney which differed markedly in color and density from the surrounding tissue. It was darker, much firmer and the normal kidney markings were blurred or absent. Even now we were in doubt as to the correct diagnosis but in view of her history, the pre-operative diagnosis and an evident lesion of some sort, nephrectomy was decided upon and was performed. Unfortunately no photograph was made of the gross specimen. The speci-

men was submitted to a pathologist who reported the area involved to be made up entirely of small round cells and ventured a diagnosis of small round cell sarcoma, which was concurred in by a second pathologist (figs. 6 and 7). Being somewhat in doubt as to the accuracy of this diagnosis, the specimen was submitted to two other pathologists. After considerable study and consultation among all of the pathologists it was finally agreed that it was not sarcoma, that the area was made

FIG. 6. SECTION FROM KIDNEY IN CASE 2

This section was taken at the border of lesion and shows normal kidney above and lesion below.

entirely of round cells, probably lymphocytes and represented a low grade inflammatory process, probably the result of an infarct. I am willing to admit that the nephrectomy was unwarranted but we were fortunate in securing a very interesting and very instructive specimen. The patient made a smooth recovery and like Case I has been carefully followed to date. She has remained entirely well and frequent examinations of her urine have failed to show any abnormal elements.

Case 3. T. J., male, married, aged forty. Admitted January 4, 1926, with the following history: He has lived in the tropics for several years. He has had several attacks of malaria of a rather severe type from which he apparently finally recovered after vigorous treatment with quinine, arsenic and emetin. In 1923 had a severe attack of tropical dysentery accompanied by and followed by a marked secondary anemia. In January, 1925, severe attack of dengue fever.

In July, 1918, severe bleeding from left kidney. Again in October, 1918, and January, 1919. For several years there was no bleeding but

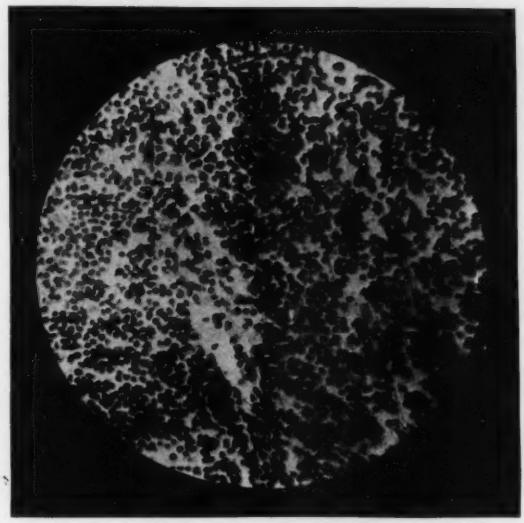


FIG. 7. HIGH POWER VIEW OF SECTION OF LESION SHOWN IN FIGURE 6

he had a more or less constant dull ache referred to left loin. In January, 1925, another attack of bleeding from left kidney. In April, 1925, was submitted to a very exhaustive examination in another clinic with essentially negative findings. In September, 1925, examination of urine was negative except for occasional granular casts. (We never found any casts at any of our examinations.) In December, 1925, another attack of bleeding. Examined at this time at still another clinic. At this time the examiner reported an obstruction in left ureter which he was unable to pass.

FIG. 8. PYELOGRAM OF CASE 3 SHOWING APPARENT FILLING DEFECT

This pyelogram when compared with a similar one made several months before showed an apparent increase in the filling defect. Chiefly on this fact a tentative diagnosis was made of renal tumor.

Examination on January 4, 1926, shows a fairly healthy-looking individual, although somewhat anemic. General physical examination essentially negative. Hemoglobin, 85 per cent; red blood cells,

FIG. 9. SECTION REMOVED AT FIRST OPERATION FROM ONE OF SEVERAL DEPRESSED AREAS IN CASE 3

Very low power. Note fibrosis with healthy surrounding tissue, apparently an old infarct.

5,184,000; white blood cells, 7200; polymorphonuclears, 69 per cent. Blood chemistry: Urea, 82.6; creatin, 2.71; sugar, 153. Blood Group II.

Cystoscopy. January 5, 1926. The bladder is normal except for a

suggestion of edema above left ureter orifice. No. 5 catheters passed readily to the kidney pelvis on each side. The phenolsulphonephthalein

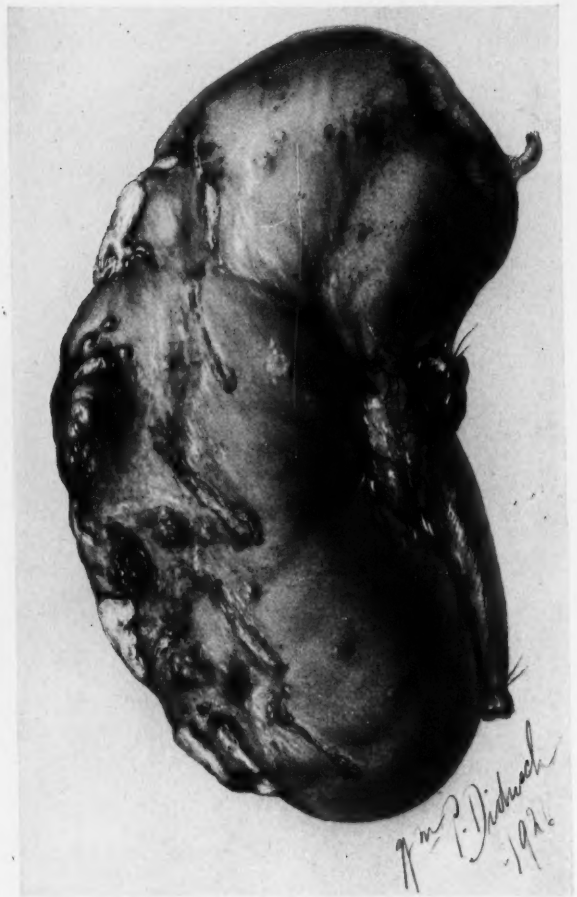


FIG. 10. KIDNEY REMOVED FROM CASE 3

output was normal and equal on the two sides. The urines showed no abnormal elements except a considerable number of calcium oxylate crys-

tals and were sterile. X-ray showed a left kidney somewhat enlarged, in normal position; no calculi were noted. Injection of 7 cc. of 15 per cent sal of soda iodide into the kidney pelvis and 3 cc. into the left ureter showed an atypical pelvis (fig. 8). The upper calyx was very narrow, none of the minor calices showing in normal outline. There was a narrowing of the left ureter just below the pelvic line with moderate dilatation of the ureter above this point. The pyelogram suggested a filling defect and when compared with a pyelogram made in another clinic nine months previously suggested an increase in this filling defect. On the strength of this a provisional diagnosis was made of tumor and exploration advised.

Operation on January 15, 1926. The kidney was readily delivered on the loin and appeared somewhat enlarged otherwise normal except for several depressed areas on cortex. It was rather widely split. There was no tumor but the depressed areas previously noticed showed more definitely and gave the impression of small scars. The kidney markings were otherwise perfectly normal. A small section was removed from the cortex at the site of one of the depressed areas and also a small section from one of the papillae. The kidney wound was repaired with the usual mattress sutures with apparently perfect hemostasis. Pathological report on the sections removed was as follows (fig. 9):

Tissue of kidney: normal papilla and healed infarct of kidney.

Specimen consists of two pieces. One is smaller, measures 3 mm. in diameter, was removed from the tip of a papilla. Grossly it shows nothing unusual but brown kidney tissue. The other piece is larger, measures 7 mm. in diameter and 4 mm. in thickness. The surface of this shows a drawn in scar. The scar measures 3 to 4 mm. in diameter. On cross section this scar corresponds to a narrow wedge-shaped fibrosis hard in consistency which is surrounded by apparently normal kidney tissue.

Microscopical sections of the small piece shows the collecting tubuli with cuboidal epithelium. Some of the tubuli contain red blood cells. Microscopical section of the larger piece shows the depression with thick fibrous surface. Beneath this sharply defined wedge-shaped area shows dense fibrosis which is mostly hyalinized. There is rich infiltration of lymphocytes throughout this. In the border zone dilated tubuli are seen with colloid secretion.

The urine continued very bloody for three days and then began to clear. On the night of the sixth day it became very bloody again and

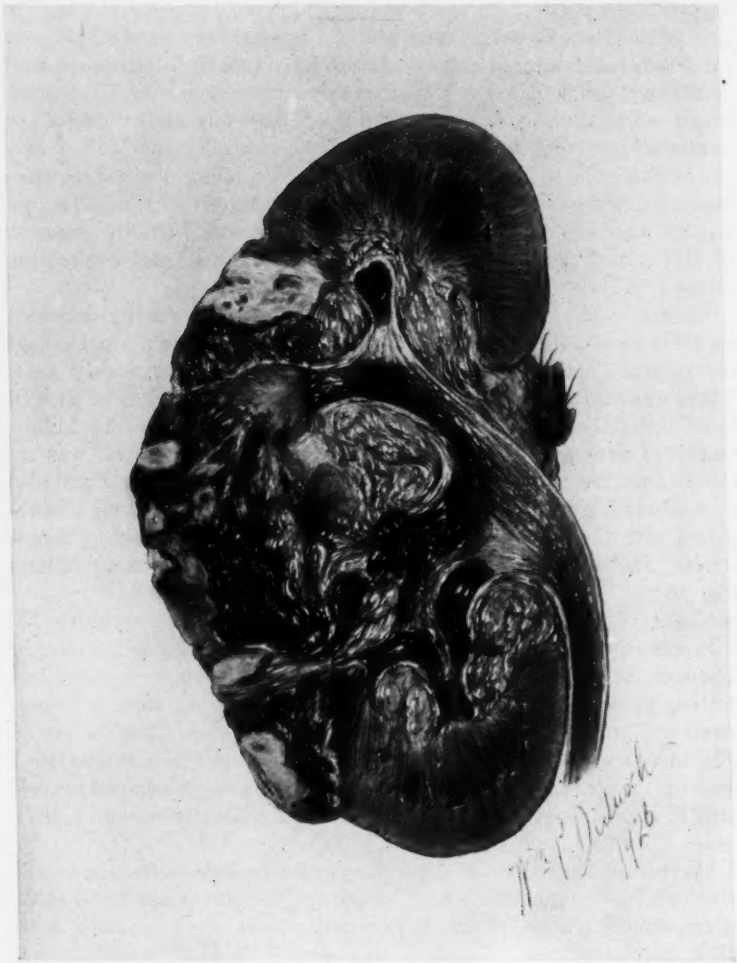


FIG. 11. SAME KIDNEY AS FIGURE 10 WIDELY SPLIT
Recent pathology has almost completely masked the older lesions

on the morning of the seventh day the patient presented all the evidence of an intensely acute anemia. He was transfused with 750 cc. of

citrated blood and a rapid nephrectomy performed (figs. 10 and 11). The area about the kidney and the kidney itself were found distended with clots. He went on after this to an uncomplicated recovery.

FIG. 12. SECTION FROM KIDNEY SHOWN IN FIGURES 10 AND 11
Recent hemorrhage in pyramid surrounded by necrosis

The report on the examination of the kidney by Dr. Nicholas M. Alter is as follows:

Chronic and acute pyelonephritis; thromboangitis with old and recent infarction.

Kidney weighs 290 grams, measures 14 by 9.5 by 5 cm., capsule strips with some difficulty leaving irregular surface. Surface is pale

yellow brown, in color with numerous irregular bulgings and depressions. Some of these are red, others are white. There are also star-like drawn in scars. The white areas are sometimes very small. On cross section very numerous smaller and larger wedge-shaped areas

FIG. 13. ANOTHER SECTION FROM SAME KIDNEY

Border zone of fresh hemorrhagic infarct, anemic necrosis, all outlines indistinct.

are seen; some of which are red and hemorrhagic, others are necrotic and anemic. Two of the pyramids are places of extensive hemorrhages. Each measures about 5 cm. in diameter; seem to consist of fresh red clot. The star-like scars correspond to fibrous areas reminding of healed infarcts. The renal pelvis is dilated and about 5 cm. in diameter and

also filled with a large amount of red clot. Lining of the renal pelvis is smooth and thickened, shows also extensive hemorrhages. Smaller hemorrhages are covering the tips of all papilla. The lining of some calices show old white scars.

Microscopical sections show a great variety of pathological pictures. There are large areas of older and recent hemorrhages. The older hemorrhages show organization with fibrosis. The recent hemorrhages are surrounded by inflammatory reaction which is marked by polymorphonuclear leucocytes. Other sections show extensive areas of necrosis with uniformly granular unstained tissue where the structure of the kidney is partly preserved. Some of the areas of necrosis show replacement by fibrosis. Older lesions show complete replacement by organization as described in S.P. 42. Definite changes are seen in most vessels. They are surrounded very often by infiltration and lymphocytes and polymorphonuclear leucocytes in varying amount. The intima of some vessels shows hyperplasia of endothelial cells. The lumen of some vessels contains hyalinized material, in others adherent clot of red blood cells and fibrin.

Note: For the study of vessel changes further study is in progress (figs. 12 and 13).

Of course the lesion in this case did not warrant a nephrectomy but this operation was forced upon us as a life-saving measure. It is my theory that the scars noted represented the scars of a series of infarcts. The pathological picture of the kidney removed is of course much confused by the recent changes which occurred following the nephrotomy. There is, however, evident an underlying picture which preceded these changes.

As I said at the outset of my paper, I am thoroughly conscious of the fact that speculation proves nothing and that the amount of clinical material studied and even smaller amount presented is entirely too small to warrant any conclusions. Nor do I wish to make the error of other days by attempting to include in blanket form all cases of renal bleeding which can not be accounted for in some other way. I wish merely to call attention to a type of pathology which in my opinion does account for a certain number of a group of cases whose nature has not as yet been explained with entire satisfaction. This paper is presented in the hope that it may stimulate further thought and investigation along this or similar lines.

DISCUSSION

Dr. Arthur H. Crosbie (Boston): It seems to me in cases of the sort Dr. Rathbun has reported, it would be wise to try palliative measures before doing nephrectomy. I have had quite a number of cases of hematuria in which I have done a nephrostomy, with complete relief of the symptoms and relief of the bleeding.

At the last meeting of this Society in Washington, I reported a case that had bled for seven years from his left kidney. At no time during those seven years had his urine been free from blood.

The pyelograms, as you may remember, in that case were entirely negative. I operated on that kidney and found it to be perfectly normal as far as I could tell. I freed up the ureter, did a nephrostomy, and did a nephropexy.

At the time I reported the case, it was eight months since the operation. I saw the man two weeks ago, and he has had no return of his bleeding, no return of the pain, and his urine now contains no microscopic blood. He is the case that had been bleeding the longest.

I have had quite a number of these in which I have done merely nephrostomy plus a nephropexy, with entire relief of the symptoms. It seems to me we ought to try palliative measures, and if they do not work then do nephrectomy.

Dr. Richard F. O'Neil (Boston): I am very much interested in this subject of Dr. Rathbun's. I was rather surprised to hear him say that all bleeding kidneys were painful. This has not been my experience. I can recall two which have had no pain whatsoever.

A recent case of which I would like to show the pyelogram, was a boy of eighteen, who came to the service in April. He had a history of hematuria for about six weeks. He gave a history of having fallen on the ice and traced it to that, but as he struck

himself between the hip and the knee, I can see no connection between the injury and the bleeding.

He had profuse intermittent hematuria. All methods of examination were negative. This, as far as I can see, is a perfectly normal pyelogram. The urine was negative for tuberculosis and culture. The non-protein nitrogen and phthalein were normal. There was no tumor.

We cystoscoped him, and catheterized the ureters—the bleeding was from the left kidney. He has not bled since the cystoscopy. It is only two months to be sure. These cases vary greatly clinically. Some stop of themselves. Others stop following lavage, ureter catheterization or a pyelogram, others continue and yield to nephrotomy or decapsulation; some may require nephrectomy. So it seems to me that the treatment should be palliative for some time.

In Dr. Rathbun's cases he was fortunate, or unfortunate, as you may see it, in having had to do nephrectomy. He was able to get histological material from three cases, and if I understood him rightly they all showed areas of chronic nephritis which, it seems to me, is the explanation in these cases. It has been called "focal nephritis," and it seems to me that he bears that out in his cases.

I have never done a nephrectomy in these cases so I have no pathological report for my own series.

I had one case, a woman, which was done five years ago; she had a symptomless hematuria. Every method of examination was negative, but the bleeding was quite profuse and she was getting a secondary anemia. We did an exploration, decapsulation and suspension, without any relief. At the end of a year, she was still bleeding. The case was reoperated, a nephrotomy was done. This time the kidney was much more carefully examined. A large aberrant vessel was found going to the lower pole of the kidney and was tied off. That was five years ago and the patient has not bled since.

Dr. FRANK S. PATCH (Montreal): Our pathologist and myself have been particularly interested in the sclerosis that follows

acute cortical nephritis. We have taken every opportunity to observe such cases, both clinically and in the post mortem room. I must admit that we have been unable to confirm Dr. Rathbun's theory that the bleeding was the result of these scleroses, because in our experience, in the cases of sclerosis that we examined, there was conspicuous absence of hematuria. In none of the cases that I can remember, was there any evidence of marked hematuria.

One of the early cases that I studied clinically was some years ago, that of a man who was bleeding from the left kidney. After thoroughly studying the case, we could find no cause for the bleeding, and regarded the case as one of essential hematuria, although I am of the opinion that essential hematuria is a name that merely serves as a cloak, for our ignorance of the exact condition present. In this case, I cut down upon the kidney, thoroughly explored it, and even did a nephrotomy, but was unable to find anything. The bleeding promptly subsided after the nephrotomy. The man came back within six months bleeding from the opposite kidney. There had been absolutely no return of the hematuria on the operated side. This time, a thorough examination revealed the previous negative findings. I merely did a decapsulation, which was followed by complete cessation of the bleeding, without return in the ten years which have elapsed since the operation.

Since that time, many cases of so-called essential hematuria in which palliative measures have been tried and failed, have been relieved by a simple decapsulation. How the decapsulation works, it is really difficult for one to say. In a number of these cases, in the course of the decapsulation, we separate adhesions, for it must be admitted that in these sclerosis cases, with areas of old cortical nephritis, one finds usually more or less epinephritis or perinephritis. In those cases, whether it is due to the separation of the adhesions, or whether it is due to the removal of sympathetic fibers in the capsule, as has been suggested by Rovsing and Papin, decapsulation will work just as well as nephrostomy, and is certainly more conservative than a nephrectomy.

Dr. William F. Braasch (Rochester, Minn.): The subject of essential hematuria is a most interesting one. I am under the

impression that it would be difficult to assign any one cause to the variety of conditions which are grouped under the term essential hematuria.

There is unquestionably an inflammatory etiology in some of these cases, as Dr. Rathbun has said. There may be various forms of infection, such as renal papillitis, pyelonephritis, or possibly multiple areas of nephritis involving the cortex and causing scar tissue, as Dr. Rathbun described.

On the other hand, a non-infectious etiology may also be present. Dr. Quinby reported a very interesting series of cases several years ago with marked dilatation of the blood vessels of the renal papilla.

Recent investigations made by Dr. Conner and Dr. Bumpus at the Mayo Clinic led us to believe that there may be a factor present which has not been recognized, namely, the presence of a blood dyscrasia. They found a comparative diminution in the number of blood-platelets in a surprisingly large number of cases of essential hematuria. With this there were also other clinical data present suggestive of a blood dyscrasia of a purpura type.

This possibility is corroborated by the fact that many cases of essential hematuria will be controlled by intramuscular injections of blood serum, either autogenous or horse serum. However, there are arguments against this etiological factor being present in many cases, so that it will be necessary to fit the etiology to each separate case.

It is generally recognized that this condition is not surgical, except from an exploratory standpoint. All of them can be controlled by non-surgical methods, such as pelvic lavage, with an increasing percentage of silver nitrate, as Dr. Geraghty called attention to, and intramuscular injection of autogenous blood serum.

In former years we employed surgical treatment such as decapsulation and nephrotomy. While it is true that many of the cases of bleeding did stop, it would be illogical to regard the surgical treatment as the only factor in causing the cessation of bleeding.

It is very questionable whether true nephritis is a common etiologic factor. In a review of our cases of essential hematuria made several years ago, we failed to find evidence of the usual forms of nephritis appearing later on. Certainly they did not die the death of nephritis.

This is certainly a very interesting subject and I congratulate Dr. Rathbun on the very careful study he has made of the cases.

Dr. FRANCIS R. HAGNER (Washington): This is certainly a most interesting subject and I have been interested in it for many years. I believe that the Mayo Clinic has a chance here to clear up some things that probably none of the rest of us have.

I believe, as Dr. Braasch says, that there are many causes for hematuria.

You will all remember a case of mine that bled for thirty-five years in which the hemorrhage ceased after catheterization of the ureter never to return to this date. I saw him last year (it is eighteen or nineteen years since he was catheterized) and he is still in good health. The explanation of this is not clear. Of the many cases of symptomless hematuria that we treated years ago, I refer especially to four or five of those patients seen in the last stages of arterio-renal disease, while infection unquestionably bears some import in these things, I believe undoubtedly the bleeding is an early arterial renal change in the kidney, not a distinct nephritis; possibly a change in the blood vessels of the kidney causes this bleeding.

I think it would be very interesting if Dr. Braasch would go over the cases that they studied years ago and look up the mortality in those cases, and try and find the cause of death. Because I cannot help but feel (of course, my experience is not nearly as large as theirs) from the cases I have seen that their termination has been due to arterio-renal disease.

Dr. HERMON C. BUMPUS, JR. (Rochester, Minn.): I have been very much interested, as Dr. Braasch has said, in this work.

Several years ago Dr. Meisser and I ran a series of some twelve or fifteen cases in which we injected laboratory animals with

cultures from supposed foci. In not one of these cases did we get a positive result, although, clinically, the removal of foci seemed to be beneficial. I remember one case very distinctly, in which the hematuria ceased as a result of lavage with silver nitrate; then when cleaning up the foci, returned as soon as a tooth was extracted some two weeks after the bleeding had ceased. There seems to be a very close relationship between foci and this idiopathic hematuria, as this experience has occurred several times.

In recent years, Dr. Connor and I have investigated the matter from the blood dyscrasia standpoint, and we have found that we had a low platelet count in the majority of cases—usually below 150,000. We wanted to check this with a normal series so asked several of the staff to have their platelet count taken. I did this with the rest, only to find my platelets were 90,000. So there you are!

Dr. HENRY G. BUGBEE (New York): I would like to show one or two slides, if I may, which show the ease with which tumor of the kidney may be overlooked as a cause of hematuria.

(Slide) In this patient, there was no change in function of the two sides. On two occasions over a period of several months, this patient had noticed a slightly bloodish tinge to the urine, but there was no real hematuria. On ureteral catheterization, we found microscopic blood cells on this side, and the opposite kidney negative. We found staphylococci in the urine, and we had this filling defect, which is not very well marked.

The point that I wish to bring out is the importance of repeated pyelograms. This patient had no symptoms whatever, simply noticed a bloodish tinge on two voidings over a period of two months, but there were microscopic blood cells in the urine.

(Slide) This later pyelogram shows a very marked filling defect in the kidney pelvis.

(Slide) This shows the tumor that was found at operation. There was no change in function on the two sides, just microscopic blood cells in the urine. It is very easy to overlook such a tumor of the kidney in the early stages.

(Slide) Here is another filling defect with no profuse hematuria,

but an occasional bloody tinge to the urine. The catheter is in the upper calyx and, although the fluid is injected into this calyx no filling takes place although the lower calyces are well outlined. This was a hypernephroma.

(Slide) Here we have a filling defect in the pelvis of the kidney, and no frank hematuria. This was also a case of a malignant papillary cystadenoma of the kidney.

(Slide) Here we have a woman with profuse hematuria, and the x-ray shows these calculi.

(Slide) However, when the kidney was removed, the sections of the kidney showed an adenoma of the kidney, and the calculi themselves did not account for her hematuria.

(Slide) This is a microscopic section of the adenoma.

Dr. ALEXANDER RANDALL (Philadelphia): Dr. Keyes prompted me to possibly skim a little cream from a subject that we are interested in, in regard to essential hematuria. We were talking about it at a clinic in Philadelphia at a joint meeting with New York a little while ago.

Some fourteen years ago, I was writing a paper on essential hematuria. It was a paper of a theoretical nature, and I was trying to explain these cases in which active pathology is absent on some physiological or anatomical grounds. Recently, one of my co-workers has turned over some rather interesting findings in regard to a physiological factor.

There has been an enormous amount of interesting work done on the reflexes between the bladder and the renal pelvis, and I will not burden you with the various sides of it, except to say that there is a very definite reflex arc that seems to exist between the renal pelvis and the bladder.

There is also, anatomically, a very interesting muscle in the renal pelvis, a circular muscle about the papilla in the upper cornu of the calyces. The point we are working on is whether or not these cases of so-called angioma of the papilla, or the so-called hemorrhagic papillitis (the pictures which we have seen in specimens with definitely marked points where the bleeding undoubtedly arises) could not be due to a spasm of that circular

muscle. The anatomists give to this muscle a function of actually milking the papilla—and that the secretion from the tubules is not simply a sort of oozing out, but that there is an actual suction created, first, by this annular muscle at the papilla base, as I say, milking the papilla of its fluid into the pelvis, and following on down the pelvis as the start of the peristaltic wave.

It has been a rather troublesome thing to attack, for one peculiar reason: that there are very few experimental animals that have papilla similar to the human and at the present time, the only one we have found that anywhere near simulates it, to work with experimentally, is the calf. So that at the present time we are being very attentive and polite to our veterinary school and they are giving us access to the calves' operating table where we can experiment with renal papilli and their function.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): Before closing the discussion, I would like to ask Dr. Crowell this hypothetical question: In case he did have a patient who showed a slight dilatation, and he decided there might be an obstruction in the ureter, with frequency, how would he cure that patient?

Dr. A. J. CROWELL (Charlotte): Answering Dr. Braasch I will say the patient was cured by doing a ureterolysis, liberating the ureter from bands of adhesions, and leaving a retention catheter in for four days to obliterate the kink and hold the ureter in its normal position until it was fixed. This did away with the pain produced by the obstruction offered by the kinked ureter.

As to the treatment of stricture, I believe the retention catheter is the best method. I think this far better than simple intermittent catheterization.

Dr. N. P. RATHBUN (Brooklyn): I think you have treated my speculations rather charitably. I want to make myself clear on one point and that is that I am not recommending nephrectomy nor any other form of radical surgery for bleeding kidneys. These three cases were selected from my group not to

illustrate a method of treatment but simply because they made available material for study.

Dr. O'Neil, I think, misinterpreted some of my slides when he assumed that they represented a form of chronic nephritis. I will admit that the first case was a perfectly typical picture of a chronic diffuse nephritis. It differs from the ordinary nephritis in that it had a perfectly good function and the patient is alive and well, nine years later, with no evidences of any trouble in the other kidney.

In regard to the question of sclerosis that Dr. Patch spoke of, and the fact that they do not bleed, it so happens that at least in one of these cases, that was the only lesion we found and it seemed rather natural to associate cause and effect.

I think Dr. Braasch summarized my idea of the situation when he said that we must not look for one, single cause as accounting for these cases of bleeding. There may be a variety of causes, such as Dr. Bugbee showed, of very early renal tumor.

This matter of blood dyscrasia does not seem so tremendously important because all the cases I have seen have confined themselves to one kidney, and there is no reason why they should not bleed from both kidneys if they are constitutional or blood dyscrasias.

HORSESHOE KIDNEY WITH ESPECIAL REFERENCE TO THE IMPORTANCE OF PRE-OPERATIVE DIAGNOSIS

J. A. C. COLSTON AND W. W. SCOTT

Baltimore, Maryland

Previous to the use of the diagnostic methods now so widely in use in the study of urological problems, a pre-operative diagnosis of horseshoe kidney was practically unknown, although such clinicians of wide experience as Israel (1) and Rovsing had made such a diagnosis without the aid of the cystoscope, the former in four cases and the latter in two. Rovsing states that "to make the diagnosis it is necessary first of all to think of it." The great majority of cases then were discovered either at autopsy or recognized only on operative exposure. The comparatively frequent occurrence of the condition and its anatomical anomalies, which modify to such an important degree, the different surgical procedures applicable to it, make the recognition of horseshoe kidney of paramount importance in the surgery of the kidney. An operator who does any appreciable amount of kidney surgery will inevitably at some time face the problem of a surgical horseshoe kidney. If the diagnosis can be correctly made before operation is undertaken, the surgeon will be able to attack the problem confidently, with the necessary modifications in technique so that the dangers of hasty and too forceful manipulation on operative exposure before the true condition is recognized will be entirely obviated.

Horseshoe kidney was first recognized by Vesalius and the older anatomists in the course of dissections and autopsies. Heuer (2) in 1902, made a comprehensive study of the subject, in which he defined the condition "as a congenital malformation consisting in the connection, more or less intimate, in front of

the vertebral column, of two similar poles of the kidneys, affecting more or less exactly the form of a horseshoe with equal or unequal branches."

The frequency of the occurrence of horseshoe kidney is fairly constant according to the statistics of the writers who have compiled figures on this subject. Carlier and Gerard (3), in a study of 68,989 autopsies, found 80 horseshoe kidneys, a ratio of 1 to 862. Morris and Socin (4) (quoted by Kelly and Burnam) in a compilation of 16,000 cases found a similar percentage figure (0.8 per cent) for the occurrence of the anomaly. Küster (5) found one case in 1100. In smaller series Nauman (6) found a ratio of 1 to 600 and Davidsohn (7) 1 to 1000.

For a correct understanding of the anatomy of horseshoe kidney a brief discussion of the embryology is essential. During the first part of the fourth week of embryonic life, a small delicately formed epithelial outgrowth appears at the lower end of the Wolffian duct. Over its outer surface, fitting like a cap, a group of cells, probably derived from the mesonephric blastema can be observed. From this epithelial outgrowth the ureter, pelvis, calyces and the collecting tubules of the kidney are derived. The rest of the kidney substance originates in cells derived from the mesonephric blastema group. It is at this stage that the two kidney buds or anlagen are situated below the umbilical arteries and consequently they are quite close together, being separated only by a thin layer of mesoderm. Within a few days they ascend above the level of the arteries and as a result become more widely separated. Thus, fusion, if it occurs, usually takes place before the kidneys start to separate. The kidney pelvis, which at this time is situated anteriorly, starts to rotate toward the midline, the position it definitely occupies during the seventh week of embryonic life. Within a week or two the kidney has so rotated on its long axis that the pelvis is posterior, its normal position in adult life. The fact that in the great majority of cases of horseshoe kidney reported, the pelves have been located anteriorly, proves quite conclusively that fusion must have occurred before the seventh week

of embryonic life, that is, before the kidney had rotated to such an extent that the pelves were situated posteriorly.

Although horseshoe kidneys resulting from fusion of the lower poles are most commonly found, other variations do occur. Beyer (8) in a study of 262 cases of horseshoe kidney found fusion of the upper poles occurring in 18 instances. In these cases, it sometimes happens that the adrenals are also fused as illustrated by Broedel (4). This possibility should never be forgotten when radical surgery is contemplated in such cases.

The isthmus varies markedly in size, shape and the character of tissue of which it is composed. It may consist of a fibrous band or a membranous cord, as reported by Küster (5) and Schuchardt (10). On the other hand, the bridge may be broad and thick and composed of secreting tissue as is usually the case. Occasionally, the bridge is so thick that it almost simulates a third kidney, but in these cases there is usually a marked inequality in size between the two real kidneys. As a rule the bridge is from 2 to 8.5 cm. broad and composed of true renal tissue. It is usually situated anterior to the aorta and vena cava, but may be either behind or between these vessels (10 per cent of cases). The isthmus when fusion of the lower pole is present is usually situated at the level of the fourth or fifth lumbar vertebrae, at about the level of the bifurcation of the aorta. Of course, in the much more rare instances of fusion of the upper poles, the isthmus is situated considerably higher.

The pelves for the most part are normal in size and structure, and never fused. Occasionally, however, a ureter will be found entering the parenchyma of the kidney with little or no tendency toward a true pelvis formation. Such a condition existed in one of the cases to be reported in this series (fig. 1). Also there are a few cases reported in the literature where an additional ureter was found leading to the isthmus and in these cases the pelvis may either be lacking or only rudimentary in character.

Unfortunately for the surgeon the blood vessels leading to and from horseshoe kidneys are subject to marked variations. The arterial vessels which usually spring from a level on the aorta that is lower than normal, take an obliquely downward

course to the kidney. The blood vessels very frequently enter the kidney on the posterior aspect of the pelvis rather than anteriorly. The arteries are usually multiple or if single, not infrequently branch before entering the kidney. In addition

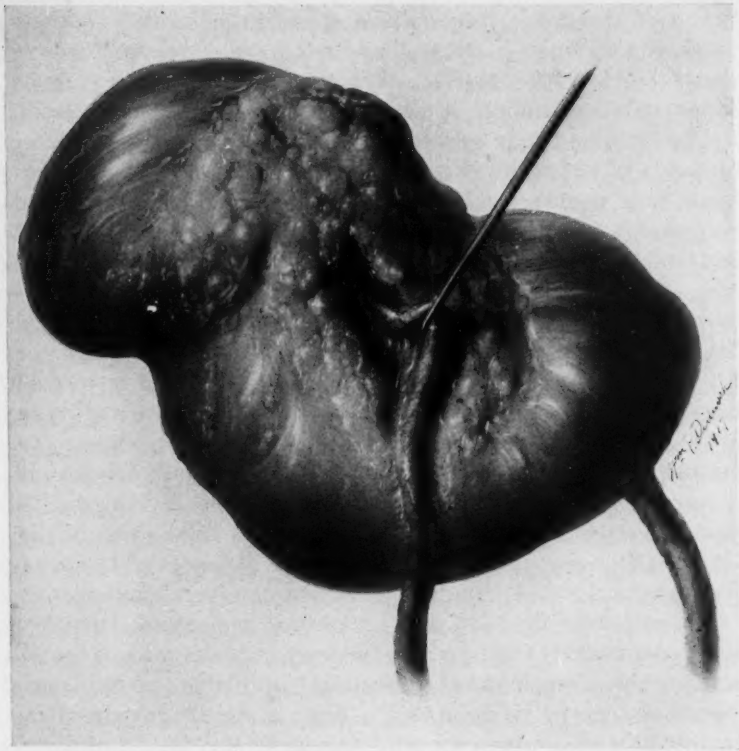


FIG. 1. HORSESHOE KIDNEY WITH PROBE LIFTING ADHERENT RIGHT URETER AND LEFT URETER ENTERING DIRECTLY INTO PARENCHYMA AT LOWER POLE

to the blood supply obtained from the aorta, smaller arterial branches are commonly found entering the kidney on the isthmus from the inferior mesenteric, common iliac, external iliac and internal iliac arteries. A special artery supplying the

isthmus is often found leading from the aorta at a point below the origin of the inferior mesenteric artery. Cases have occurred in which a single trunk from the aorta was present dividing to supply branches to the two kidneys and to the isthmus.

From the foregoing it can readily be seen that marked variation in arterial supply is the rule and the veins are even more numerous and often have an entirely different distribution. These facts are of the greatest importance in the surgical treatment of the horseshoe kidney and if a correct pre-operative diagnosis has been made the operator will bear these facts in mind and the danger of serious hemorrhage from injury to an anomalous vessel will be minimal.

The horseshoe kidney is, of course, subject to the various diseases, which may occur in the normally formed organ and on account of the anomalous position of the pelvis, the course of the ureters over the isthmus and their liability to partial obstruction there by pressure of abnormally placed vessels and other structures, the incidence of pathological lesions is far higher than in normally formed kineys. Naturally, one would expect to find the predominant type of disease to be those varieties which experience has taught us to be associated with partial or complete ureteral obstruction and studies of pathological horseshoe kidneys show conclusively that this assumption is correct. In a series of pathological conditions Rathbun (11) showed that calculus, hydronephrosis and pyonephrosis occurred more frequently than all other types of lesions combined, although the incidence of tuberculosis was surprisingly high.

The symptoms caused by a horseshoe kidney per se are of little significance and may practically be disregarded. Rovsing describes dull, indefinite abdominal pain usually located below the epigastrium and states it is characteristic for this pain to be present when the patient is up and about and for it to disappear in the prone position. He explains this pain is due to the fixation of the isthmus while the kidneys are movable with the body. Any pathological lesion present in a horseshoe kidney will of course run a similar course and give rise to symptoms practically indistinguishable from a similar lesion in a normally formed kidney.

For the recognition of horseshoe kidney the x-ray is of paramount importance and a diagnosis made without recourse to this method must necessarily be tentative. However, such diagnoses have been correctly made, notably by Rovsing and Israel. It is first of all necessary to remember the possibility of the existence of such an anomaly and in a few cases the so-called Rovsing's sign—pain in the erect position which disappears on lying down—may be helpful. In some individuals with thin abdominal walls a palpable mass may be felt extending across the midline.

With the refinements of present day technique the shadows of the kidneys can be made out in part, at least in every plain roentgenogram. In horseshoe kidney the outlines will be seen to be lower in position than is normally the case and to lie closer to the vertebral column. The lower poles will be indefinite, as contrasted with the rest of the shadows, and often the outline of the isthmus itself can be seen extending across the vertebral column to join the two organs. In such cases, a stereoscopic roentgenogram will often bring out the isthmus very clearly and in two of our cases stereoscopic plain films alone sufficed to make the diagnosis fairly certain.

The pyelogram, however, is our one most certain method of diagnosis just as it is in tumor of the kidney. An otherwise unexplained shortening of one or both ureters may be noted, but the position and configuration of the pelvis is unmistakable. It will be found to lie lower and more toward the midline and all the calices will tend to take a downward direction instead of the normal distribution, and some of them will turn toward the vertebral column. One of our cases shows this reversal of the direction of the calices beautifully and in this film it will be noted that all the calices leave the pelvis and take a downward course toward the midline (fig. 2). Stereoscopic pyelograms are of the utmost importance, especially when the pelvis has not been completely filled with the opaque medium. In such films the ureters can be seen bending forward to ascend over the isthmus and when the pelvis has been completely filled it can be seen plainly lying in its characteristic anterior position. By

the application of these measures horseshoe kidney can be diagnosed with a very high degree of certainty and the operative mortality must of necessity be reduced.

The operative technique is modified by the presence of the pelvis on the anterior aspect of the kidney, by the abnormal number and distribution of the vessels and by the fixation of the organ by the isthmus. The kidney is approached extraperitoneally by the usual incision, but on account of the isthmus, exteriorization will be impossible. Great care to avoid vessels must be taken in approaching the pelvis and the position of the latter anteriorly must be remembered, but with these facts in

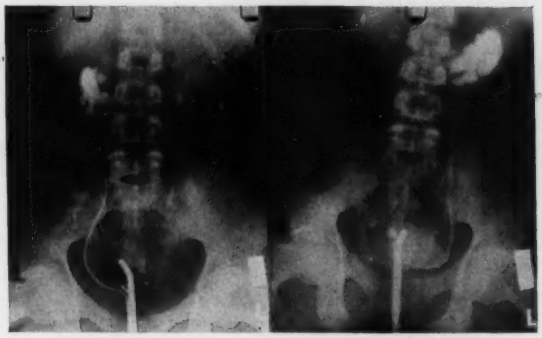


FIG. 2. HORSESHOE KIDNEY SHOWING REVERSAL OF DIRECTION OF CALICES AND STONE IN PELVIS OF LEFT KIDNEY

mind, the operation should not prove unduly difficult provided that perinephric inflammatory changes have not occurred.

Judd, Braasch and Scholl (12) in 1922 reported the occurrence of 17 cases of horseshoe kidney in 2424 operations on the kidney. They made a pre-operative diagnosis in 8 cases.

Bottez (13) in a collection of 320 cases showed that symptoms were present in 52. These statistics are quoted to show the frequent occurrence of pathological conditions in the horseshoe kidney.

Löffler (14) collected 108 operations on horseshoe kidney, in only 12 of which the correct diagnosis had been made before operation.

Rathbun (11) in 1920 reported 3 cases with one pre-operative diagnosis and from Eisendrath's bibliography collected 106 cases in 24 of which a correct diagnosis was made before operation. It is interesting to note that four of the correct diagnoses were made by palpation alone.

Rathbun's compilation of the operations is especially illuminating in the light that it throws on the mortality of operations on horseshoe kidneys. He collected 52 heminephrectomies with 8 deaths, 18 pyelotomies with 1 death, 9 nephrotomies with 2 deaths, 6 divisions of the isthmus with 1 death, 1 liberation of ureteral adhesions, 1 decapsulation, 1 ureterotomy and 20 exploratory operations with 1 death.

This totals 108 operative procedures with 13 deaths, a percentage far in excess of the mortality for a similar series of operations on the normally formed kidney. It would hardly be too much to assume that, had the correct pre-operative diagnosis been made, these figures would have been greatly reduced.

REPORT OF CASES

Case 1. M. B., B.U.I. No.12454, aged thirty-three. June 9, 1924.

Complaint. Pain in left kidney region.

Family history. Not important.

Past history. Aside from the two attacks of acute gonorrhea, the last occurring when the patient was twenty-three years of age, and a soft chancre eighteen months previous to admission, his past history was unimportant.

Present illness. Eight months previous to admission he began to have intermittent attacks of dull pain over the left kidney region. One month later he had a definite attack of colic with pain radiating down the course of the left ureter to the scrotum on that side. So far as he knew there was no blood in the urine. For the next seven months he had a more or less constant dull ache of kidney, complicated by attacks of moderately severe colic every two or three days.

Physical examination. Presented practically negative findings.

Special examinations. Urine contained many pus cells and a few cocci. No red blood cells were present in urine on examination. Plain x-ray showed a small stone in left kidney pelvis and definite shadow connecting the lower poles of both poles, indicating the presence of a

horseshoe kidney. On *cystoscopic* examination, the bladder was found to be normal. Ureteral catheters were passed up both sides, cultures obtained and a double pyelogram taken. The *cultures* were negative for infection and the *pyelogram* was quite typical for a horseshoe kidney.

A *left pyelolithotomy* was performed on June 11, 1924. A typical horseshoe kidney with a well formed isthmus was found (fig. 3). The blood vessels entered the lower pole of the kidney. The ureter passed over the isthmus and entered the pelvis which was situated anterior to the blood vessels. An aberrant vein entering the kidney in the region of the uretero-pelvic junction was divided (fig. 4). The pelvis was next opened and the stone which was located in the lower major calyx was removed. The opening in the pelvis was

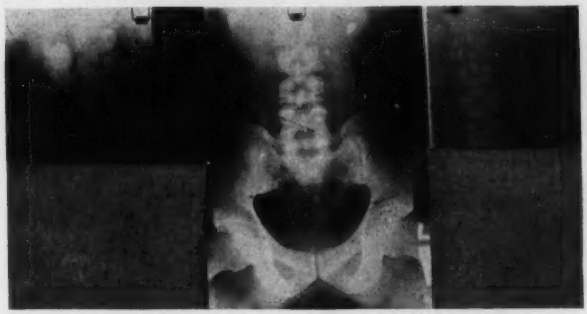


FIG. 3. PLAIN PLATE SHOWING TYPICAL HORSESHOE KIDNEY WITH STONE IN LEFT PELVIS. PYELOGRAMS SHOWING REVERSAL OF CALICES AND HYDRONEPHROSIS OF RIGHT SIDE

closed with a fine continuous catgut suture, a tube drain placed and the wound closed.

The patient's *post-operative course* in the hospital was very satisfactory. He was discharged on July 1, 1924. Since then he has returned for observation on several occasions, the findings always being negative.

Case 2. W. G. Y., B.U.I. No. 14041, aged thirty-four.

Complaint. Pain in left kidney region.

Family history. Of no significance in this case.

Past history. Unimportant. No history of an infection of the genito-urinary tract.

Present illness. On February 15, 1925, the patient was seized with a sudden severe pain in left kidney region. The pain which was practically constant became so severe that the patient was taken to a hosiptal early the next morning. Because he could not void, it was necessary to place him on interval catheterization for two days. All urine obtained contained blood, macroscopically. At the end of this period the patient started to void but noticed that his urinary stream would

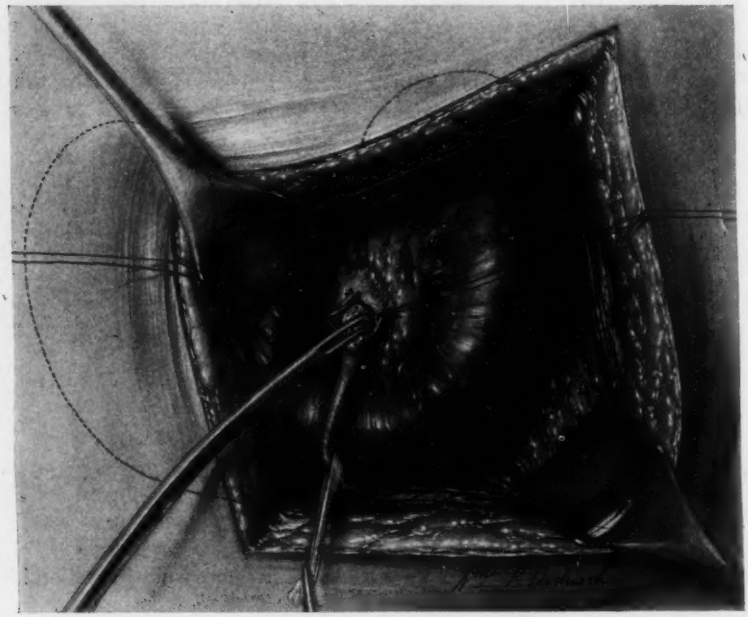


FIG. 4. EXPOSURE OF HORSESHOE KIDNEY AND REMOVAL OF STONE

suddenly stop. On cystoscopic examination a small vesical calculus was found and removed per urethram. During this attack he had evidently passed the stone from the left kidney. Following the removal of the stone, he was free of all discomfort for two weeks when he had another attack of left renal colic. He again returned to the same hospital where a plain x-ray proved negative for stone. For the next six weeks he had recurrent attacks of colic of such severity as to incapacitate him for work. After this there was a period of two months

in which he was absolutely free from pain. Then he had another attack of colic and came to the Johns Hopkins Dispensary where a plain plate revealed a stone at the uretero-pelvic junction of the left side of a horseshoe kidney. His urine was not infected but contained numerous red blood corpuscles.

During the next six weeks he was instrumented many times in the hope that it might be possible for him to pass the calculus. Finally a

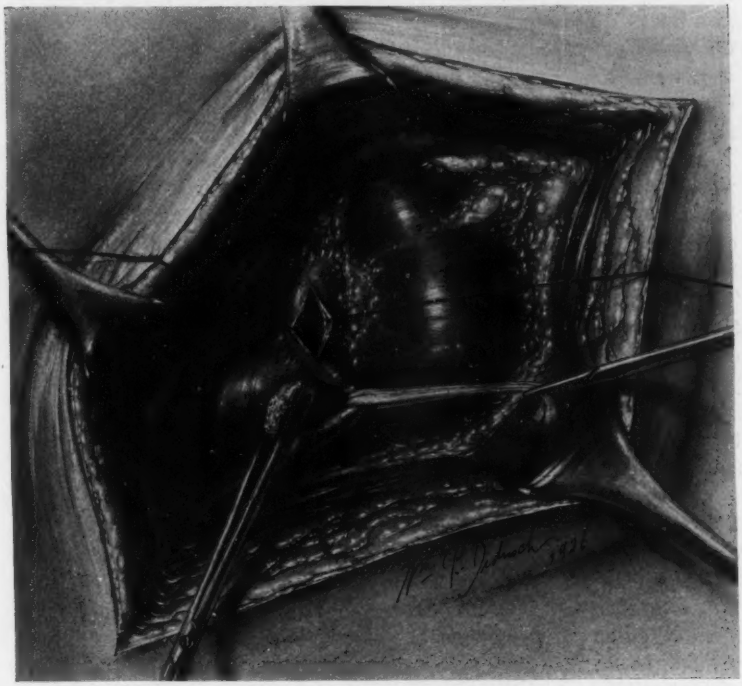


FIG. 5. EXPOSURE OF HORSESHOE KIDNEY SHOWING ANTERIOR POSITION OF PELVIS AND STONE REMOVED

pyelogram was taken and following this he had such a severe attack of colic on the left side that it was necessary to admit him to the hospital. Cultures obtained from both kidneys were negative for infection. In as much as he had a total output of phthalein of 63 per cent for two hours, was free from pain and desired very much to leave the hospital, he was discharged on the following day.

On November 18, 1925, he had a typical attack of left renal colic, the pain radiating along the course of the left ureter to the upper part of scrotum on that side. He was again admitted to the hospital on the following day when a plain plate showed the stone to be in the left kidney pelvis.

General physical examination. Resulted in negative findings.

Special examinations. The *urine* which was not infected, contained a few red blood cells. His total phenolsulphonphthalein output for two hours was 63 per cent, the phthalein appearing in ten minutes. On *cystoscopic examination* the bladder, vesical and ureteral orifices were found to be normal. Catheters were easily passed up both ureters. Cultures from both sides were negative for infection. A *pyelogram* showed a calculus in the left pelvis of a horseshoe kidney (see fig. 2).

A left pyelolithotomy was performed on November 23, 1925. It was found that the lower poles of both kidneys were attached by a thin layer of renal tissue (fig. 5.) The ureter passed to the outer border of the isthmus of the kidney pelvis which was situated anterior and just below the renal blood vessels. No aberrant vessels were observed. The pelvis was opened and stone easily removed, with ureteral stone forceps. The opening in the pelvis was closed with a continuous suture of fine plain catgut, a drainage tube placed down to the opening in the pelvis and the wound closed.

The patient had an uneventful convalescence, leaving the hospital twenty days after the operation. Three examinations of the urine since his discharge from the hospital have been negative for infection.

Case 3. Dr. A. B. C., aged forty-three. B.U.I. No. 12587. (Private case of Dr. H. H. Young.)

Complaint. Blood in urine.

Family history. Aside from the fact that father died of carcinoma of the lip at age of eighty-one, the history is negative.

Past history. In 1921 the patient developed a partial paralysis of left arm. There was no disturbance of speech or any other neurological finding at that time. About the middle of November, 1923, slight aphasia appeared. There is a history of Neisser infection in 1906 which was successfully treated and was not followed by any complications. However, he contracted another gonorrheal infection in 1911, following which he developed prostatitis and epididymitis.

Present illness. The patient first noticed blood in his urine in September, 1923. Since then macroscopic blood has appeared in the

urine for a day or two each. Microscopic blood has always been present. In January a plain x-ray taken in Chicago showed a small stone in the left kidney pelvis. At that time the presence of a horseshoe kidney was suspected. When seen in the Brady Urological Institute in July, 1924, his urine contained macroscopic blood. There was no hesitancy, frequency or dysuria.

Physical examination. In as much as the patient was treated as an out-patient, a general physical examination was not obtained.

Special examinations. The bladder *urine* contained many red blood cells, a moderate number of white blood cells and an occasional bacillus.

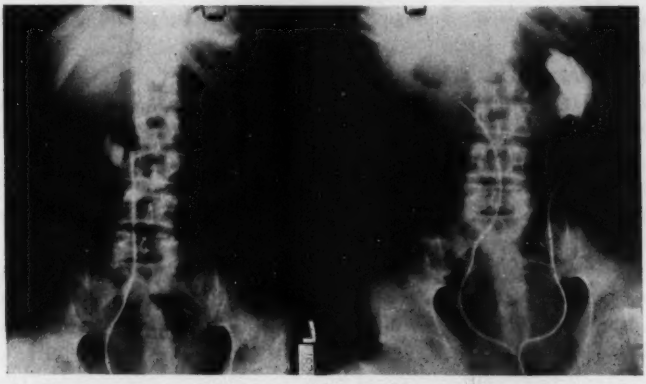


FIG. 6. PYELOGRAM OF HORSESHOE KIDNEY SHOWING REVERSAL OF CALICES AND VERY SMALL STONE IN DILATED PELVIS OF LEFT KIDNEY

There was slight prostatitis. On *cystoscopic* examination, a residual urine of 20 cc. was found. There was early median bar formation with slight trabeculation of the bladder wall. The trigone was slightly hypertrophied, but otherwise normal. No. 7 catheters were passed to both kidneys without meeting any obstruction. The *phenolsulphonphthalein* test showed an excretion of 50 per cent in the first and 10 per cent in the second, making a total output of 60 per cent for two hours. The differential functional test with phenolsulphonphthalein showed an output of 20 per cent in one-half hour from the right kidney and 22 per cent from the left. Plain *x-ray* examination revealed a stone in left kidney. *Pyelograms* of both sides were taken and as a result a horseshoe kidney with a stone in the left pelvis was discovered (fig. 6). On account of the relatively few symptoms, the small size of the stone and the presence of hypertension no operation was advised.

Case 4. D. W. F., aged fifty-eight. B.U.I. No. 6484. November 10, 1917. (Private case of Dr. J. T. Geraghty.)

Complaint. Tumor in abdomen.

Family history. Unimportant.

Past history. Unimportant.

Present illness. For thirty years the patient had noticed a mass in right side just below the ribs. This had neither enlarged nor caused any discomfort until six months previous to admission. About that time it seemed to increase in size, and became quite tender and painful. Simultaneously with the onset of these findings, attacks of nausea and vomiting occurred. In one of these attacks he vomited blood. These attacks were always preceded by rather intense non-radiating pain in region occupied by the mass. Not long afterwards he developed nycturia (once a night) and slight daily frequency. In all other respects his history was negative.

Physical examination. Essentially negative with the exception of abdominal findings. Just to right of midline at the level of the umbilicus, there was a firm, irregular mass about 12 cm. long in its greatest diameter, having no areas of tenderness and moving quite freely with respiratory movements.

Special examinations. Urine not infected. On *cystoscopic* examination the bladder was essentially negative. Catheters were passed up both ureters without difficulty. Specimens of urine from both sides contained considerable blood, in fact, the apparent lack of function on left side was attributed to a stoppage of the catheter by a blood clot. The *phthalein* output from the right side in thirty minutes was 27 per cent. There was practically no output from the left side, but this was attributed to presence of a blood clot in the catheter. *Pyelograms:* Through the ureter catheter 11 cc. of thorium was injected into right kidney pelvis and a pyelogram was taken. Only 3 cc. could be injected up left ureteral catheter before the pain became intense.

A *pre-operative diagnosis* of hypernephroma was made, although the possibility of a horseshoe kidney was mentioned.

An *exploratory operation* was performed on November 19, 1917. A horseshoe kidney was found, the right portion of which was but one-third the size of the left (see fig. 1). The connecting isthmus was quite narrow. One ureter was found running over the lower pole of the kidney and entering a large pelvis which lay between the upper and lower portions. The whole kidney was rotated so that the pelvis was situated anteriorly.

This pelvis drained the entire right and a large part of the left kidney, or in other words about four-fifths of the renal tissue. The other ureter which entered the lower pole of the left kidney on its anterior surface had no pelvis attachment. This accounted for the fact that only 3 cc. of fluid could be injected up the ureter. The mass felt abdominally and which was thought to be tumor proved to be the larger left portion of the kidney.

Following the operation the patient had an uneventful convalescence, leaving the hospital in four weeks. He was free from pain at that time.

CONCLUSIONS

1. Horseshoe kidney is a congenital anomaly of sufficiently frequent occurrence to make it of great importance to all doing renal surgery.

2. The anomalous position of the pelvis, the abnormal number and course of the vessels and the fixation of the isthmus greatly modify the operative technique.

3. A correct pre-operative diagnosis can be made in a very high percentage of cases where all the modern methods at our disposal are employed.

4. A study of the plain radiogram, the pyelogram and especially of the stereoscopic pyelogram, where proper technique has been used, will give the most valuable information that can be obtained.

5. Operative statistics show that the mortality percentage in horseshoe kidney is far higher than similar figures for operations on the normal kidney.

6. These higher figures are to some extent, at least, due to the lack of a correct pre-operative diagnosis.

REFERENCES

(1) Israel: Diagnosen und Operationen bei Verschmolzenen Nieren. Folia Urologica, 1908, Bd. i, 617.

(2) Heuer: Ueber Hufeisennieren. Diss. Leipsig, 1902.

(3) Carlier et Gerard: Anatomie Chirurgicale et Chirurgie du rein en Fer à Cheval. Rev. de Chir., 1912, xlvi, 9 and 197.

(4) Kelly and Burnam: Diseases of the Kidneys, Ureters and Bladder, vol. ii, p. 317.

(5) Küster: Die Chirurgie der Nieren, der Harnleiter und der Neben-nieren-Stuttgart, 1896–1902.

(6) NAUMAN: Uber die Häufigkeit der Bildungsanomalien der Nieren, Kiel 1897.
(7) DAVIDSOHN: Ueber die Hufeisenniere, Charite Ann., xxvi, 1902, 509.
(8) BEYER: La Rein en fer à Cheval. Arch. Internat. de Chir. 5, 1912, 517.
(9) ROBINSON: The blood vessels in fused (horseshoe) kidney. Lancet-Clinic, 1909, 141.
(10) SCHUCHARDT: Berl. Klin. Wchnschr., 1892, xxix, 833.
(11) RATHBUN: Notes on the clinical aspects of horseshoe kidney. Jour. Urol., 1920, ii, 611.
(12) JUDD, BRAASCH AND SCHOLL: Horseshoe kidney. Trans. Sect. Urol. Amer. Med. Assoc., 1922, 146.
(13) BOTTEZ: Considerations sur la Pathologie et la Chirurgie du rein en fer a Cheval. Jour. d'Urol., 1912, 193.
(14) LÖFFLER: Operations on horseshoe kidneys. Ztschr. f. Urol. Chir., 1924, xvi, 181.
(15) HESS: Surgical horseshoe kidney. Report of an unusual case. Jour. Urol., 1924, xii, 627.
(16) KIDD, F.: A case of horseshoe kidney. Pyeloradiogram. Rovsing's operation for separation of the fused kidney. Proc. Roy. Soc. Med., London, 1922, xv, Sect. Urol., 52.
(17) JUDD, BRAASCH AND SCHOLL: Horseshoe kidney. Jour. Amer. Med. Assoc., 1922, lxxix, 1189.
(18) MORSON: Two cases of horseshoe kidney. Brit. Med. Jour., 1923, i, 236.
(19) CARL: Heminephrectomy for pyonephrosis of a horseshoe kidney. Zentralbl. f. chir., 1923, i, 506.
(20) PALMER: Cases of horseshoe kidney. Internat. Jour. Med. and Surg., 1924, xxxvii, 325.
(21) KAHN: Horseshoe kidney with external pelvis. Successful heminephrectomy. Kentucky Med. Jour., 1923, xxi, 679.
(22) KINARD: Nephrotresis for recurrent bilateral pyelolithiasis in horseshoe kidney. Jour. Amer. Med. Assoc., 1923, lxxxi, 2077.
(23) VORHOEVE: The roentgenological picture of horseshoe kidney. Forschr. a. d. Geb. d. Roentgenstrahlen, 1923, xxx, 211.

A CASE OF CALCULUS PYONEPHROSIS IN A CROSSED ECTOPIC NON-FUSED KIDNEY

NATHANIEL G. ALCOCK

Iowa City, Iowa

G. P., male, twenty-six years of age, graduate student in the University, was first admitted to the University Hospital on April 20, 1925, with the following history.

The patient had three separate groups of symptoms:

First: About three weeks previous to his admission to the hospital he had an attack which simulated an acute or subacute appendicitis so far as symptoms and laboratory findings, including negative urine, were concerned. The physical findings were in accord with this diagnosis, except that a mass as large as one's fist could be definitely palpated in the region of MacBurney's point where there was also much tenderness and rigidity. On account of this mass, his physician, Dr. A. W. Bennett, of Iowa City, Iowa, who recorded the above symptoms, felt that he was not dealing with a typical case of appendicitis, and as the patient was improving, he deemed it safe to watch developments. An immediate appendix operation, therefore, was not advised. The recovery was uneventful and the patient was back at work in about a week. The urine remained persistently negative. There were no bladder symptoms, or symptoms referable to either kidney at this time, or at any previous time.

Second: On the afternoon of April 19, 1925, the day preceding his admission to the hospital, he quite suddenly developed frequency and urgency of urination, together with some burning and smarting. He was awakened about 4 a.m. the following morning with a severe pain in the right back exactly in the region of the right kidney. He had never had any of these symptoms before. The pain continued to get worse and in about an hour he called his physician. He was voiding every few minutes and the urine was grossly bloody and the sediment showed many pus cells. The pain was located exactly in the region of the right kidney and radiated around the groin. The tenderness was more marked posteriorly than anteriorly. The mass at MacBurney's point was neither tender nor painful and could be very defi-

nitely palpated. The pain subsided immediately after the administration of a hypodermic and the hematuria decreased, and in three hours the urine showed only microscopic blood together with much pus.

Third: The patient gave a history of having had attacks during the preceding year of pain in the posterior portion of the left thigh along the course of the left sciatic nerve radiating down the course of the nerve as far as the knee. These attacks would come on quite suddenly and last from half an hour to half a day. They were not severe enough to prevent walking and were accompanied by no other symptoms. We did not take this symptom into consideration until he was cystoscoped.

When he was brought to the hospital on April 20, 1925, he was having very little pain in the region of the right kidney, but there was definite tenderness and rigidity over this organ. There was practically no tenderness over the mass and it could be easily palpated at MacBurney's point. The urine showed pus, and microscopically there was hematuria. The leukocyte count was 8000, and the temperature normal.

X-ray pictures showed a shadow 1 by 1.5 cm. on the right side just below the brim of the bony pelvis in the region of the upper portion of the lower third of the right ureter.

The patient was immediately cystoscoped. The bladder was negative. Both ureteral orifices were in their normal locations and urine could be seen spurting from the right ureteral orifice.

The right ureter was catheterized with a No. 6 catheter and the catheter passed the full distance without meeting with any obstruction. There was no residual urine in the right pelvis and the kidney was secreting normally and its urine was negative. The capacity of the right pelvis was 15 cc. and pelvic distention reproduced exactly the pain which the patient had had earlier that same morning, and the pain was distinctly different from that which he had had three weeks previous.

Nothing larger than a No. 5 catheter could be passed into the left ureteral orifice and this catheter could only be advanced about 10 cm. A few drops of thin pus came from the left catheter. The left kidney was not secreting. Eight cubic centimeters of water could be injected through the left catheter, and as this was being injected the patient complained immediately of pain along the course of the left sciatic nerve exactly the same as the pain he had had in this same region with the several attacks during the preceding year. Injecting and withdrawing the water in this way exactly reproduced these attacks. With this amount of water injected through the left catheter he also complained of some slight pain in the region of MacBurney's point located exactly

as the pain of his attack three weeks previous. When the water was withdrawn from the left side it was loaded with pus cells.

FIG. 1. URETERAL CATHETERS IN PLACE, SHOWING THE RIGHT CATHETER PASSING TO THE MEDIAN SIDE OF THE STONE SHADOW WHICH IS INDICATED BY THE ARROW

Phthalein given intravenously appeared from the right catheter in three minutes, and during the following fifteen minutes the right kidney put out 7 per cent of the dye. In twenty-five minutes not a trace of

phthalein had appeared from the left catheter and there was less than 1 per cent in the bladder at the end of this time. The phthalein test was repeated some weeks later and again nothing came through the left kidney, while 25 per cent came through the right one in a fifteen-minute period.

Pictures were taken with the catheters in place and uretero-pyelograms were made on each side, and gave the following result: The right ureter passes upward just to the inner side of the stone shadow and then turns outward and upward to end in a slightly dilated right pelvis, which is located high up. With the exception of slight dilatation, the right pelvis is negative. The left ureter passes out of the bladder normally and after going upward about 2.5 cm. it turns and crosses the pelvis to the right side and ends in the left kidney pelvis, which is located at about the brim of the bony pelvis on the right side. The pyelogram of this pelvis shows the findings characteristic of a large pyonephrosis and the shadow of the stone can be seen within the pelvic outline. Several pictures were taken and in many of these the lower pole of the right kidney can be definitely made out and can be seen to be high up above the mass at MacBurney's point, and on account of this finding a diagnosis of crossed ectopia *without* fusion was made.

The patient wished to complete the college year before he was operated and, therefore, the operation was postponed until June 12. In the interval he had no symptoms to speak of, but the pyuria persisted and a few blood cells could always be found in the urine.

He was operated on June 12 under an ethylene anesthesia. The left ectopic kidney was removed transperitoneally. When exposed the kidney was found to lie at the brim of the pelvis on the right side immediately over the right common iliac artery. It was a typical pyonephrosis with much dilatation of the pelvis—probably better termed, an infected hydronephrosis with stone.

The hilum pointed to the right and downward and the ureter took an acute turn to the left just as it left the pelvis. The blood vessels arose, as near as I could tell, either from the aorta at its bifurcation or just below from the right common iliac artery. There were two arteries. The pedicle came to the kidney at the mid-point of its greater curvature, and here the vessels divided themselves into two groups. The larger group coursed over the anterior surface of the kidney substance and then dipped into the kidney at the hilum. Some of them dipped into the kidney substance before they reached the hilum. The other group of vessels coursed over the posterior surface of the kidney

in a similar manner. Both of these groups of vessels left a definite groove in each surface of the kidney. There was no fatty capsule.

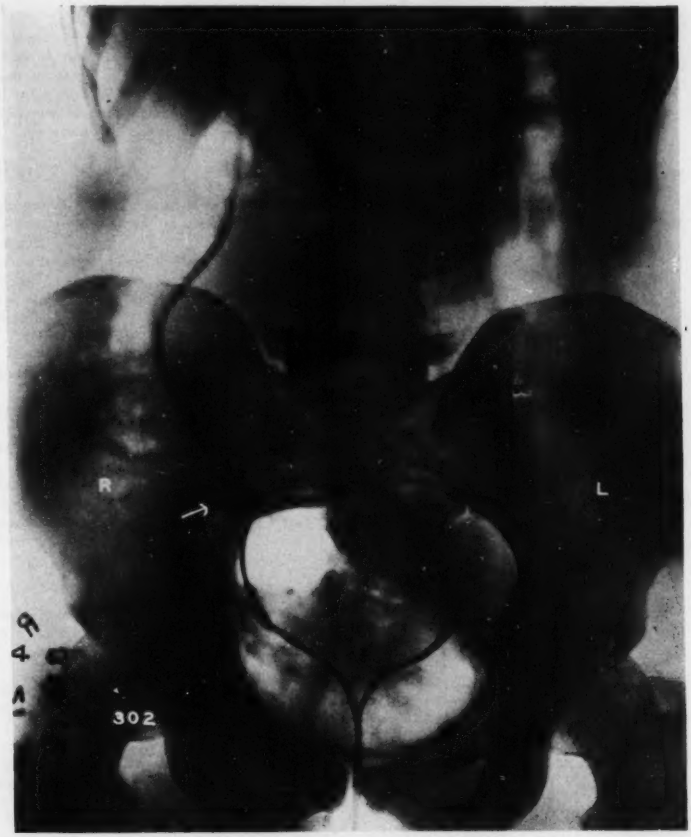


FIG. 2. LEFT URETERO-PYELOGEAM SHOWING LEFT URETER CROSSING OVER TO THE RIGHT SIDE

The large pyonephrotic sac can be seen against the right ilium and the arrow indicates the location of the stone shadow.

The right ureter came down behind the left kidney pelvis and was almost imbedded in the pelvis and necessitated very careful dissection to

TABLE 1
Crossed ectopia non-fused

AUTHOR	DATE	AGE	SEX	ECTOPIC KIDNEY	LOCATION OF ECTOPIC KIDNEY	NUMBER AND ORIGIN OF ARTERIES	PATHOLOGY IN THE ECTOPIC KIDNEY	OTHER KIDNEY
1. Rokitansky	1861	56	F.	Left	Below right kidney	One from right common iliac	None	Normal
2. Weisbach	1867	24	M.	Left	Below right kidney over right common iliac artery	Three from right common iliac and aorta	None	Normal
3. Brigidi	1880		F.	Left	Below right kidney	One from aorta	None	Normal
4. Graser	1893	37	M.	Left	Below right kidney	Not mentioned	Large hydronephrosis	Normal
5. Schultz	1894	32	F.	Right	Below left kidney	One from aorta	None	Normal
6. Kohler	1900	21	F.	Left	Below right kidney	Two from aorta and right common iliac	Chronic nephri	Chronic nephritis
7. Schuhmacker	1903	2 mo.	F.	Left	Right iliac fossa	From aorta	None	Normal
8. Ghosal	1905	30	F.	Left	Left above right on right side	Not mentioned	None	Below ectopic kidney
9. Meyer	1908	3 weeks		Left	Below right kidney	Two from aorta	None	Normal
10. Heiner	1909	38	M.	Left	Below right kidney	Not mentioned	Not mentioned	
11. Plummer	1910	38	M.	Left	Below right kidney	Not mentioned	Not mentioned apparently n	Normal
12. Bugbee	1910	16	F.	Left	Right lower quadrant	Not mentioned	Infantile type pvis; mild gr pyelitis	Normal
13. Bugbee	1914	33	F.	Bilateral	See text	Not mentioned	Tuberculosis right kidney; pyelonephriti left kidney	
14. Huffman	1924	Adult	M.	Left	Below right kidney at brim of pelvis	Five from aorta and right common iliac	None	Normal
15. Herbst	1924	Adult	F.	Right	Below right kidney at brim of pelvis		Small hydronephrosis	Small hydronephrosis
16. Beer	1925	45	M.	Left	Below right kidney	Not mentioned	Calculus pyonephrosis	Normal
17. Alcock	1925	26	M.	Left	Below right kidney	Two (?) probably form aorta or right common iliac	Calculus pyonephrosis	Small hydronephrosis

TABLE 1

Non-fused kidneys

OTHER KIDNEY	SYMPTOMS	DIAGNOSIS; HOW MADE	OPERATION	RESULT	CAUSE OF DEATH	CYSTOSCOPY AND PYELOGRAPHY
Normal	Not known	Cadaver				
Normal	None	Autopsy	None		Pulmonary tuberculosis	No
Normal	None	Autopsy	None		Pellagra	No
Normal	Pain in bladder and abdomen; hematuria	Operation and autopsy	Drainage of hydronephrosis	Death	Pneumonia	No
Normal	None; tumor in LLQ.	Autopsy	None		Meningitis	No
Chronic nephritis	Those of nephritis	Autopsy	None		Uremia	No
Normal	None	Autopsy	None		Pneumonia	No
Below ectopic kidney	None	Autopsy	None		Dysentery	No
Normal	None	Cadaver				
		Autopsy			Not mentioned	
Normal	Pain in lower right abdomen	Operation	Nephrectomy	Death	Uremia and infection	No
Normal	Pain and tumor in right lower quadrant	Pelvography and palpatation of lower pole right kidney	None			Yes
	Of renal tuberculosis	Autopsy	Nephrectomy left	Death	Anuria	Cystography but no pyelography
Normal	Not mentioned	Cadaver	None		Not mentioned	
Small hydronephrosis	Pain and tumor in left lower quadrant	Pelvography and outline of lower pole of left kidney	None			Yes
Normal	Pain and tumor in right lower quadrant	Pelvography and operation	Nephrectomy left	Cure		Yes
Small hydronephrosis	Abdomen and lumbar pain; pyuria and hematuria	Pelvography outline of lower pole right kidney	Nephrectomy left	Cure		Yes

get it free. Had one not known the exact course of the right ureter it would have been extremely easy to have injured it The nephrectomy otherwise was comparatively easy. A cigarette drain was left in. The patient made an absolutely uneventful recovery and has had no recurrence of any of the symptoms during the eleven months of postoperative observation. The pyuria disappeared within a few days.

The kidney when removed was larger than normal, but no different from what one would expect in a calculus pyonephrosis of a normally located organ, except for the grooves made by the course of the vessels across it.

There are two types of crossed ectopia, that in which the two kidneys are fused, and second, that in which the two kidneys are without fusion. Kretschmer, in reviewing the literature up to 1924, on the former type, found 91 cases, and since then a few additional ones have been reported, making a total to date of about 96. The second type—*without* fusion—is much less common and a careful review of the literature up to date reveals only 17 cases, as shown in table 1.

Several of the cases in the literature reported as crossed ectopia without fusion failed to show, on careful examination of the report, to be of this type either in that fusion was present or the ectopia was not of the crossed variety. Dorland mentions 4 cases falling in this group. A careful perusal of his report failed to sustain the claim in 3. Dorland also mentioned the fact that Mennacher found 9 of this type in the literature and added another of his own, but a careful review of these reports show that all of these 10 cases were of the fused variety. Papin and Palozolli in 1910 were able to collect 10 cases of this type, but 1 in that group reported by Sutherland in 1898 is not of the crossed type.

Of the 17 cases reported, 9 of them were in females and 7 in males, and in 1 the sex was not mentioned. In 2 the right kidney was ectopic, being located on the left side. In 14 the ectopic kidney was the left one. In 1 case—that reported by Bugbee —and found in 1914, both kidneys were crossed; the right one being in the left kidney fossa and tuberculous; the left one being in the right kidney fossa and showed a mild grade of

pyelonephritis. This is the only case of bilateral crossed ectopia found in the literature. The urological examination was not completed and the real diagnosis was made at autopsy.

FIG. 3. BILATERAL PYELOGRAM, SHOWING LOCATION OF THE RIGHT KIDNEY

The location of the ectopic kidney was below the normal kidney in every case except that of Ghosal, and in this case the crossed left kidney was above the uncrossed right kidney. In

this case also the ureters opened one above the other in the bladder, and therefore, it is difficult to tell which kidney was right and which was left. This is the only case in the series where the ureter to the crossed kidney did not end in its normal location in the bladder. In all other cases the trigone was either normal or nearly so.

PATHOLOGY

In 2 cases no mention was made of pathology. In 8 cases no pathology was found. In 3, the pathology was very slight, being a small hydronephrosis in one; a mild pyelitis in another, and a chronic nephritis in the third. In 1 case there was a large hydronephrosis; another a tuberculosis, while in 2 there were large calculus pyonephroses. In all cases the uncrossed kidney was either normal or showed only very slight pathology.

DIAGNOSIS

In 3 cases the diagnosis was made in the cadaver; in 9 cases it was made at autopsy and in one of these it has been suggested at the time of operation. In Plummer's case it was made only at operation, and in Beer's case the pre-operative diagnosis was that of crossed fused ectopia with a calculus pyonephrosis in the crossed kidney. The diagnosis in this case of non-fusion was not made until operation. In the remaining 3 cases—Bugbee's, Herbst's and my own—a diagnosis was clinically made by means of pyelographies, and in each of these 3 cases the matter of non-fusion was made evident by being able to palpate the lower pole of the upper kidney in Bugbee's case, and by being able to see the lower pole of the upper kidney in Herbst's case and that of my own.

OPERATION

Five of the 17 cases were operated, and the result was death in 3 and cure in 2. Four of the operations were nephrectomies and 1 was a drainage. The drainage of a large hydronephrosis resulted in death from pneumonia. In Plummer's case of

nephrectomy it was quite evident that there was injury to the ureter of the good kidney during the nephrectomy, and death resulted from uremia and infection. In Bugbee's case a nephrectomy was done by a surgeon before the urologic examination was complete and the better of the two kidneys was removed, and death resulted from anuria. A cure was obtained by nephrectomy in the 2 cases of calculus pyonephrosis.

In only 5 of the cases was a cystoscopy done; the first one being by Bugbee in 1910, and this resulted in making the diagnosis.

Of the 17 cases the complete diagnosis of crossed renal ectopia without fusion was made clinically in only 3, and of these 3 it was confirmed by operation in only 1, as in the other 2 there was no indication for operation.

REFERENCES

Astraldi, A.: Archives Urologiques, July 1925, v, 85–90.

Astraldi, A., Lanari, E. L., and Egues, A.: Revista de la Association medica argentina (Sociedad de urologia), October, 1924, xxxvii, 121–131.

Beer, Edwin: Ann. Surg., 1926, lxxxiii, 433.

Brigidi, V.: Sperimentale, 1880, xlv, 474–477.

Biela Von Karltreu, A.: Surg., Gynecol. and Obstet., 1911, xiii, 306 (Dorland's case 4).

Elfving, A. B.: Acta Chirurgica scandinavica, 1925, lviii, 305–310.

Ghosal, L.: Indian Medical Gazette (Calcutta), 1905, xl, 58–60.

Gibbon, J. W.: Jeffersonian, Philadelphia, 1916, xvii, 1.

Graser, E.: Deutsches Archiv. fur klinische Medicin, 1895, lviii, 465–512.

Heiner, G.: Folia Urologica, Leipzig, October, 1908, iii, 186–232.

Herbst, Robert: Jour. Urol., 1924, xi, p. 316.

Hess, Elmer: Jour. Urol., 1924, xi, 312.

Hunter: M. Tr. (London), 1785, viii, 250.

Kretschmer, Herman L.: Surg., Gynecol. and Obstet., March, 1925, 360–366.

Kohler: (1900, case 7, as quoted in Papin and Palazzoli: Ann. d. mal. d. organ. genito-urin., Par., July, 1910, xxviii, 1195–1220.)

Linberg, B. E.: Zeitschrift fur urologische Chirurgie, 1924, xv, 315–321.

Lowsley, Kingery and Clarke: Jour. Urol., 1924, xi, 308 (case 10).

McArthur, L. L.: St. Paul Med. Jour., 1908, x, 440.

Meyer, O: Beitrage zur pathologischen Anatomie und zur allegeinem Pathologie, 1908, xliv, 1–16.

Miller, J.: Jour. Anat. and Physiol., 1908–1909 (January), xliii, 192.

Mennacher: Frankfurter Zeitsch. f. Path., Weisbaden, 1909, iii, s., 234.

Plummer, S. C.: Surg., Gynecol and Obstet., 1910, x, 431.

PLUMMER, S. C.: Surg., Gynecol. and Obstet., 1913, xvi, p. 12.
PAPIN AND PALLOZOLI: Ann. Mal. G. U., 1909, xxvii, 1681.
QUINTANA, DANTE AND LANARI: Rev. Soc. argent de urol., 1925, i, 42.
ROKITANSKY: (Lehrbuch, der Path. Anat., Bd. iii, 3 Anfl., p. 319, Vienne, 1861.) (Case 1, quoted in PAPIN AND PALAZZOLI; Ann. d. mal. d. org. genito-urin., Par., July, 1910, xxviii, 1195, 1220.)
SCHUMACHER, S. V.: Wiener Klinische Wochenschrift, (July 16), 1903, xvi, 854–857.
SUTHERLAND AND EDINGTON: Glasgow Med. Jour., 1898, xlix, 81.
SUTHERLAND AND EDINGTON: Glasgow Med. Jour., 4th series, February, 1898, xlix, 82.
SCHUTZ: Deutsche Zeitschrift fur Chirurgie, 1897, xlvi, 523–531.
WEISBACH, A.: Weiner Medizinische Woch., (January 9,) 1867, xvii, 37–40.

DISCUSSION

Dr. JOHN R. CAULK (St. Louis): This is a very fascinating group of kidney diseases, as we all know, and I think we are finding them more and more since we have been studying kidney diseases routinely.

During the last year, I have had three cases of horseshoe kidney, more than I had seen in all the rest of my career. Two of these had calculi, both bilateral; one a tumor. The calculi were all pelvic and ureteral. The tumor was left-sided.

There are many interesting things in the diagnosis of horseshoe kidney and there are many pitfalls. I just want to take up one or two points.

With regard to the x-ray shadow, plain x-ray flat plate, as a diagnostic aid in the anomalous kidney particularly the horseshoe kidney is, of course, of great value, but last week I had two stones about that size (indicating) on either side, which we found later, by pyelograms, to be in the pelvis of a horseshoe kidney. The shadows of the kidneys, themselves, were perfectly definite; I mean the lower poles were perfectly marked, and two of my men said they did not see how it could be possible for this kidney to be a horseshoe kidney but pyelograms later proved it to be the case; the calyces were pointing toward the midline.

I simply bring that to your attention to show that we cannot attach absolute importance to a complete outline of the lower pole of the kidney.

Here is the other side of it: A patient with a pyonephrosis on his left side had been pyelogrammed by another man and it looked for all the world as though it were an anomalous kidney. The pelvis on this side was pointing toward the midline. There was a large pyonephrosis, which was drained, and it proved later to be in a normally placed kidney. Probably some of the media fixed in some way or another in this purulent content simulated the pelvis of a horseshoe kidney.

The resection of the tumor which I did was quite simple because there was a definite fibrous isthmus.

My reason for mentioning this case is that the surgery was easy and the tumor was definitely separate from the other side, not involving the isthmus. The isthmus was fibrous a quarter of an inch or more, and accommodated a pedicle clamp. The tumor was resected by cautery very nicely and the patient made a rapid recovery. Within a month, there was a most ferocious spread of that tumor into the other side, and within two months the person died from an extensive carcinomatosis of the other side with pressure and bone metastasis.

Dr. GILBERT J. THOMAS (Minneapolis): I think the subject of horseshoe kidney is very interesting. I have had an unusual experience with this condition.

In two instances I have been able to demonstrate double pelves in each half of a horseshoe kidney. In one there was a stone in the lower pelvis on the left side. This patient was operated upon; the stone was removed from the lower pelvis on the left side, and palpation proved that a horseshoe kidney was present.

This photograph (showing photograph) demonstrates an example of the same condition which gives you a good idea, of the outline of a horseshoe kidney. You can see two pelves showing on one side, only one on the other. Whether I have bilateral double pelves in this patient is questionable. I am making the diagnosis of horseshoe kidney with double pelves on the pyelographic evidence and after palpation, as this patient was not operated.

Dr. Alcock's report is very interesting and well presented.

Some fifteen years ago, I was able to make a diagnosis of a pelvic kidney in a woman. This was in the midline or slightly more on the opposite side. I talked with Dr. Alcock this morning, and he is of the opinion that a number of these reports are similar to his case, where the kidney is a low one and is on the same side as the normal kidney. I was able, in this instance, to make the diagnosis before operation. Although the kidney did not contain a stone, it was grossly infected.

Dr. RICHARD F. O'NEIL (Boston): I had a very similar case to that of Dr. Alcock, except that the pelvic kidney was almost in the midline the same type that Dr. Thomas mentioned. It was an ectopic kidney, with a large calculus and secondary hydronephrosis. There were no urinary symptoms. The principal symptom was pain in the left hip for twenty years. The x-ray showed a shadow in the mid-sacral region, which was not associated with the kidney until a pyelogram was done. Then a nephrectomy was performed with complete relief. It was a most interesting and satisfactory case for diagnosis as he had been treated over a long period for arthritis, neuritis, sciatica, etc.

Dr. GEORGE R. LIVERMORE (Memphis): I would like to present a rather interesting case of horseshoe kidney, in which the patient had a stone in the pelvis, on the left side. This patient had been suffering with bladder irritation and more or less dull, aching pain in his left side. The pyelograms had been made previously by another man, so when he came to me he was very loathe about having any more cystoscopic manipulation done. Fortunately, the man let me have his plates and I checked them up with a unilateral pyelogram. The consequence was that the diagnosis of horseshoe kidney was not made prior to operation.

When we opened the kidney, we found the stone in the pelvis; we found also that the kidney mass was more or less movable, and the ureter on the left side was distinctly kinked, which had not been shown in the pyelogram. After the stone was removed by pyelotomy, we simply pushed that kidney up, and did a nephropexy. I had never heard of a nephropexy being done on a horseshoe kidney before, but by pulling the kidney up, it straightened the kink in the ureter and the patient has been absolutely relieved and says he feels one hundred per cent better than he had felt for ten years.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): It seems to me that one important feature in the discussion of horseshoe kidney has not been brought out and that is the clinical data which would lead the general diagnostician to suspect the existence of horse-

shoe kidney. This is of the greatest importance, and unless these data are generally recognized, the anomaly will frequently go unrecognized. It should be emphasized that horseshoe kidney should be excluded with every mid-abdominal pain, x-ray shadow or tumor, even though no strictly urological symptoms are present. If these data are generally recognized, the urologist will have an opportunity to discover the existence of horseshoe kidneys by means of pyelography which are usually discovered at the operating table.

The pyelographic recognition of fused kidney is comparatively simple. When the direction of the calyces is reversed and they extend median or anteriorly from the pelvis instead of laterally, and when the ureter leaves the pelvis or anteriorly from the pelvis instead of laterally, and when the ureter leaves the pelvis from the lateral border of the pelvis instead of the median, renal fusion is indicated. In order to corroborate this, a subsequent pyelogram should be made of the other side since the deformity is symmetrical with horseshoe kidney. It should be remembered, however, that the calyces may be reversed with renal torsion, due to causes other than horseshoe kidney. In such cases the deformity will be unilateral. This might occur following renal trauma, ptosis, perinephritis and with a congenital kidney with failure of complete rotation.

Difficulty might arise in differentiating between a unilateral fused kidney and an ectopic kidney. The two conditions can be differentiated by the distance between the two pelves and by the failure of rotation on the part of the normally situated kidney. I do not think I recall ever seeing a fused kidney with one normal pelvis. There is always a distinct abnormality in both pelves.

I was very glad to see that Dr. Colston did not employ routine bilateral pyelography with fused kidney. If there is one argument which stands out prominently against bilateral pyelography, it certainly is the possibility of having a hydronephrosis on one side of a fused kidney and failure of drainage of the injected medium. It makes no difference what we use. Even sodium iodide twelve per cent, which is generally used every now and

then, will cause irritation and cortical abscesses with possible death.

Dr. HERMAN L. KRETSCHMER (Chicago): May I say a few words regarding the recognition of horseshoe kidney from flat plates?

We have recognized two or three cases from the plain x-ray films alone, as Dr. Colston and Dr. Caulk brought out. In the case of one of these patients we were in position to take repeated x-ray pictures and at one time we were able to show the fused mass, and at other times we were not able to show it. So that perhaps in some of our plain films in which we do not recognize the presence of the fused mass, it may be there, only we cannot demonstrate it by means of x-ray.

Dr. J. A. C. COLSTON: I just want to take one minute, and also borrow from Dr. Rathbun's statistics again, to illustrate the importance of pre-operative diagnosis.

Dr. Rathbun collected one hundred and eight operations on horseshoe kidney, in which there were fifty-two heminephrectomies done with eight deaths; eighteen pyelotomies, with one death; nine nephrotomies with two deaths; six divisions of the isthmus with one death; one liberation of ureteral adhesions; one decapsulation; one ureterotomy; and twenty exploratory operations, with one death. This totals one hundred and eight operative procedures on the kidney with thirteen deaths, which is a percentage far in excess of the mortality for a similar series of operations on a normally formed kidney.

It seems to me if a correct diagnosis had been made in all these cases before operation, this very high figure of thirteen deaths out of one hundred and eight cases would certainly have been materially reduced.

RENAL TUBERCULOSIS

PRELIMINARY REPORT OF A CLINICAL RESEARCH PROBLEM

GILBERT J. THOMAS
Nicollet Clinic, Minneapolis, Minnesota
AND
THOS. J. KINSELLA
Glen Lake Sanatorium of Hennepin County, Minnesota

Urologists, general surgeons and practitioners for many years have had divergent opinions concerning renal tuberculosis. At present most observers favor the hematogenous route of infection; however, we are not agreed that all renal infection with tubercle bacilli is primarily bilateral.

Tubercle bacilli in the urine from one or both kidneys means the presence of a renal lesion or lesions to some of us while others will argue that a normal kidney may filter tubercle bacilli without a lesion being present (excretory bacilluria).

Pathologists report that a gross healed lesion of renal tuberculosis has not been seen at postmortem and therefore does not exist. This opinion is based on the examination of many operative and postmortem specimens, and by clinical findings none of which demonstrated the presence of such a lesion. Up to the present, few pathologists have taken the trouble to study serial microscopic sections of a tuberculous kidney for evidence of scars or healing resulting from a miliary infection.

Dr. E. M. Medlar read a paper before this society two years ago concerning some animal experiments from which he concluded that tuberculous infection of the kidney is always hematogenous in origin and that tubercle bacilli are not excreted without a tuberculous lesion being present. Dr. Medlar found bilateral infection the rule and that the number of bacilli excreted is not necessarily a guide as to the size of the lesion and that the absence of tubercle bacilli in the urine does not rule out

tuberculous lesions of the kidneys. Dr. Medlar concluded from his experiments that individual tuberculous lesions of the kidney in the guinea pig may heal. His seemingly contradictory findings concerning the number of bacilli and the size of the renal lesion may be observed when pulmonary cases are studied. With pulmonary tuberculosis the number of bacilli are not necessarily an index of the size of the lesion. Frequently we have observed patients who have large destructive lesions of the lungs, with negative sputa on smear and conversely small pulmonary lesions may produce in the sputum large numbers of bacilli at each examination.

Dr. Medlar's report was tremendously interesting to us because his conclusions answered many questions that had remained unanswered during our study of renal tuberculosis which has been in progress during the last few years. Until the publication of this paper we could not sustain many of our opinions because we had no experimental proof or pathologic data. The more recent work of Medlar wherein he has had opportunity of examining a limited number of human kidneys seems to us convincing. Although not complete and confined to a study of the early lesion of renal tuberculosis in the human, this study proves in our opinion that tuberculous lesions in the human kidney may heal.

During the last sixteen years one of us has had an opportunity of examining a large number of patients with renal tuberculosis. They were observed at the Mayo Clinic at Rochester, at the University Hospital, University of Minnesota, and during private practice in the Nicollet Clinic, Minneapolis. The majority of patients with tuberculosis of the kidney seen by physicians and surgeons in their private practice and at general hospitals have the late or destructive type of lesion. Follow up reports of many of these operated patients have convinced us that our preoperative study has not been thorough enough and that surgery is not indicated in early renal tuberculosis. If progress is made in the diagnosis and treatment of renal tuberculosis the early lesion must be recognized before destruction occurs. With this fact in mind we decided to devote our attention during

this study to the diagnosis of the early lesions. At the same time we determined to look for clinical evidence of healing with renal tuberculosis and to keep constantly in mind the possible routes of invasion, the question of primary bilateral or unilateral infection, the possibility of a normal kidney eliminating tubercle bacilli and the question of the presence of renal tuberculosis without tubercle bacilli in the urine.

This clinical research was started in a well equipped sanatorium for the treatment of tuberculosis which is situated at Oak Terrace, Minnesota, about eleven miles from Minneapolis. The resident staff of this institution is constantly striving to arrest or cure tuberculosis but they realize that to accomplish this they must be able to make a diagnosis of the early lesion before destruction in the kidney as well as in other organs takes place. Its staff is composed of careful observers always alert for new methods of diagnosis and treatment and genuinely interested in furthering our knowledge concerning tuberculosis, realizing that more knowledge means better and surer methods of treatment. The consulting staff is a large one and embraces specialists in all the fields of medicine and surgery. This institution has its own laboratories and is as completely equipped as possible. Glen Lake Sanatorium has a bed capacity of 660 including children and adults of both sexes and every patient under treatment has some active lesion of tuberculosis or is admitted as a suspect. Preference for admissions is always given to the advanced case.

PRELIMINARY URINALYSIS

Before starting a study of renal tuberculosis we realized that a number of specimens of urine must be obtained from every patient in the hospital so that a very careful urinalysis might be made. This examination must be thorough and the technique must be as complete as possible. We have changed the technique many times until the following urinalysis is now being followed:

All patients whose urine contains persistent leucocytes, pus cells or numerous epithelial cells, or other pathological ele-

ments, are further checked by means of "tube specimens," that is, the patient is prepared in the same manner as for catheterization and is then requested to void directly into a sterile receptacle. This method enables us in a great number of instances, particularly in women, to avoid unnecessary catheterization. If leucocytes, red blood cells or other pathological elements are still present in these tube specimens, catheterization is done and the patient is listed for further study according to the following routine:

From each patient, six urine specimens at weekly intervals are sedimented and injected into the *same* guinea pig. At least two of these are twenty-four-hour specimens from which a large sample, usually 200 cc. is sedimented and antiforminized. The other four injections are made from the sediment of sterile "tube specimens," not treated by the antiformin method. The guinea pigs unless they die in the meanwhile, are sacrificed six weeks following the last injection and their organs are then examined grossly and microscopically for evidence of tuberculosis. All urinals, specimen bottles and other utensils used in this study are carefully cleansed and sterilized before the specimens are collected and are used for no other purpose. This precaution is taken to prevent false positive reports because of contamination of specimens.

All patients with symptoms, positive findings or persistent inflammatory elements in their catheterized urines are listed for urologic study at which time ureteral specimens are collected for microscopic study, Z.N. stain and guinea pig inoculations.

UROLOGIC STUDY

Patients were selected for urologic study because their histories or findings revealed the following: Past or present history of urinary difficulty or symptoms assignable to the urinary tract; history of pus in the urine or the presence of cellular elements in the urine at any time; the presence of tubercle bacilli in the urine on smear or after guinea pig inoculation, temperature or failure to improve in general condition without demonstrable cause. If the above routine is followed a large percentage of the

patients in the sanatorium become subjects for urologic study. No patient was subjected to cystoscopy if his tuberculous lesion or general condition contraindicated this manipulation. Before cystoscopy was done every patient was subjected to a roentgen ray study and physical survey of the entire urinary tract. A combined renal functional estimate with phenolsulphonephthalein was made as well as a routine blood chemistry study.

As an increasing number of patients in the sanatorium become candidates for urologic study we suspect the urinary tract in every instance wherein there is an active lesion of tuberculosis. Many of these patients have a history or findings which indicate that they have had a renal infection with tuberculosis. Many of them have at the time of examination unsuspected renal lesions which are symptomless. A number of these patients in our opinion, will later develop a renal infection unless their active lesion of tuberculosis is completely arrested or cured.

If the patient is considered by the internist and not from the specialist's narrow viewpoint one realizes that tuberculosis is a generalized disease with local manifestations in various tissues of the body. This is illustrated by the fact that 85 to 90 per cent of all patients who die from tuberculosis have demonstrable lesions in the intestinal tract. May the kidney be as susceptible to infection with tubercle bacilli as the intestine?

The urologic examination of patients in a sanatorium of this size and equipment may be repeated many times during the patients residence in the institution which may be for several years. It is possible to observe changes in the kidney and its pelvis with the pyelogram and one may study the ureteral catheter urine many times. We are of the opinion that repeated examination of the urinary tract has taught us more about renal tuberculosis than any other single factor in our study.

CYSTOSCOPY

Caudal anesthesia is used routinely during cystoscopy or enough opiate is given so that the patient is asleep or is unaware of pain or discomfort during the examination. The condition of the bladder was always noted. Both ureters were catheterized

whenever possible. A bilateral functional estimate was always made and not less than 10 cc. of urine was obtained from each kidney for guinea pig inoculation. In many instances we obtained as large an amount of urine as possible from each kidney. When only an occasional tubercle bacillus is present a large amount of urine will contain more bacilli than a small amount. The specimens were centrifuged and the sediment injected into animals.

PYELOGRAPHY

Bilateral pyelograms were always made unless there was some contraindication. We found no trouble, following the injection of both renal pelves at the same time, provided a careful technique is followed. We are careful to withdraw at once as much sodium iodide as is injected and we are always sure that the eye of the ureteral catheter is in or near the renal pelvis so that injection and withdrawal of solutions may be done quickly.

Pyelograms have been of great value to us in following changes that may occur in the pelvis. We have made a diagnosis of renal tuberculosis in instances when the urine was negative and the animal inoculations negative and conversely we have reports of negative pyelograms in many instances of proved renal tuberculosis. The slides will demonstrate how the pyelogram may be used to follow the changes in the renal pelvis.

The earliest lesion of renal tuberculosis that may be visualized on the film is a filling defect produced by a tiny area of renal destruction and called a cortical abscess. This may be so tiny that it is overlooked, and usually occurs at the tip of a calyx. In many instances we are sure in spite of careful survey of our films that we have overlooked these tiny filling defects. As more pyelograms of infected kidneys are studied we are sure that we will learn to recognize many filling defects that are not now noticeable to us.

EARLY LESIONS OF RENAL TUBERCULOSIS

An analysis of our urinary statistics indicates that 11.1 per cent of patients had negative histories but positive urines, or

positive pyelograms. We have, in a few instances, demonstrated tubercle bacilli *repeatedly* in the urine from patients who have a negative history.

In this instance, miliary infections following showers of bacilli in the blood stream from infected glands occur, which are quickly overcome. Healing may occur where each tiny lesion has developed which results in a tiny scar as described by Medlar. We find after repeated examinations that 38.8 per cent of outpatients had positive urines at one time and negative at another, or positive urologic findings and history at one time and negative at another. We believe that very tiny lesions of tuberculosis may be present in the kidneys for some time before tubercle bacilli appear in the urine. Medlar's pathologic study of the kidneys from patients with no clinical evidence of renal involvement, but with active pulmonary tuberculosis reveals that not more than 20 per cent of these would have positive urines. In these instances, no deformity of the pelvic outline is produced so that the pyelogram is negative. It is evident that the location of the lesions may determine the early presence or absence of bacilli in the urine. We are of the opinion that the diagnosis of the early lesion of renal tuberculosis is very difficult and frequently impossible.

EVIDENCE OF HEALING

We are convinced that many patients who have temporary renal tuberculosis with tiny miliary lesions in their kidneys and tubercle bacilli in their urine are cured or clinically free of the disease. These lesions apparently heal or are arrested without bacilli being found in the urine. Medlar has found scars and tuberculous lesions of various grades of development in the same kidney. Our urinary studies reveal that we have found tubercle bacilli in the urine at one time and later no organisms can be found with the patient clinically well. In a few of the slides which accompany this paper certain changes have taken place in the pelvic outlines which we interpret as attempts at healing. Many patients have had urinary symptoms when admitted, which have disappeared after thorough sanatorium

management so that the patient has a clinical cure. We have all had patients with bilateral renal tuberculosis with bacilli in both catheterized urines who have affected an apparent complete cure without symptoms or other evidence of activity. In these instances, we believe that arrest or cure has occurred and that patients with such a history should be in a sanatorium for the treatment of tuberculosis until repeated examinations over a period of a year reveal no evidence of activity of the renal lesion. We cannot understand why tubercle bacilli behave differently in the kidney than in other tissues in that a renal lesion is not supposed to heal.

Since all renal infections with tubercle bacilli are hematogenous in origin both kidneys are infected equally. The renal invasion with tubercle bacilli produces tiny miliary or destructive lesions in both kidneys or destruction may be produced in one and the other kidney overcome the infection. When one or both kidneys overcome the infection healing occurs wherever the invasion with the tubercle bacillus has occurred. When gross destruction of tissue is produced complete healing probably never occurs.

BILATERAL INFECTION AND ROUTE OF INFECTION

Of the urines that we examined, 55.5 per cent indicate bilateral infection. Practically every postmortem that we perform on patients dying from tuberculosis who had positive urinary findings reveals that the patient has or has had a bilateral renal infection. We believe that tubercle bacilli are carried to the kidney by the blood stream and that every renal infection with tubercle bacilli must be primarily bilateral. One kidney may not overcome the infection as well as its mate and a destructive lesion develops. Medlar found in his pathologic material that in 8 cases out of 10 wherein both kidneys were available the condition was bilateral. Medlar's experimental work reveals that 88 per cent of the animals had demonstrable lesions in both kidneys. Post-operative reports of large series of patients show that as high as 35 per cent died in one year from tuberculosis of the remaining kidney. We are sure that many patients who die years after nephrectomy from renal tuberculosis have this

infection in the remaining kidney and that renal insufficiency hastens their death. As more patients submit to repeated cystoscopy during their stay in the sanatorium our number of bilateral infections increase.

EXCRETORY BACILLURIA

Our routine urinalysis is producing data which will permit us to formulate conclusions concerning so-called excretory bacilluria. If the normal kidney excretes tubercle bacilli without a lesion being present in the kidney we must find during our routine study of the urine many specimens containing tubercle bacilli with no renal lesion. All patients in the sanatorium have some active lesion of tuberculosis and nine-tenths of this number have active pulmonary lesions. Many have very extensive and progressive lesions. Our clinical study does not reveal evidence that a normal kidney may eliminate tubercle bacilli. Much pathologic material will have to be examined before we can prove this statement; however, the small number of kidneys that we have examined always reveal active or healed lesions of tuberculosis, if bacilli were found in the urine. Medlar examined the kidneys from 24 patients who had active advanced pulmonary tuberculosis but no clinical evidence of renal involvement and found lesions of healed or active tuberculosis in every instance. We have never removed a kidney which eliminated tubercle bacilli that did not contain a lesion of tuberculosis. In some instances serial sections have been necessary before lesions of tuberculosis could be found.

SURGERY WITH EARLY RENAL TUBERCULOSIS

The surgical removal of a kidney containing an early lesion of tuberculosis is contraindicated because this lesion may heal. Since Medlar has definitely proved from a limited number of human pathological specimens that 80 per cent of renal infections with tubercle bacilli are bilateral, we must be sure that the infection is arrested in one kidney (which may require months of observation) before the other kidney may be removed. Sana-

torium treatment should be tried before surgery is advised. If one kidney is removed because of a destructive lesion the patient should receive the benefit of sanatorium treatment until the surgeon is assured after repeated examinations that the remaining kidney has healed or is clinically well. Our experience teaches us that a large destructive lesion of tuberculosis may be present in the kidney which may not be discoverable with the pyelogram or functional estimate. In other words, the lesion may be entirely cortical. When this occurs, it is practically impossible to be sure that a supposed "better kidney" of two that are known to be infected is better than the one that will be surgically removed. Functional estimates for this purpose in our experience are not satisfactory. Many surgeons remove one kidney infected with tubercle bacilli because in so doing they are ridding the body of one source of infection without removing any of the patient's resistance, so that the patient is better able to arrest the remaining lesions of tuberculosis in the remaining kidney or elsewhere.

CONCLUSIONS

Although our study has been under way for three years it has just begun. We know that much time and effort must be expended before we will accumulate enough data to permit us to formulate definite conclusions. This preliminary report is made to create discussion and at the same time encourage suggestions based on the experience of our listeners. This will assist us in our study. We suggest the following.

1. Every patient infected with tubercle bacilli is a candidate for renal tuberculosis. The physician and the patient may notice no symptom indicating this infection. Repeated urologic examinations including complete urinalysis and animal inoculation will reveal many unsuspected cases.

2. Tissue destruction with renal tuberculosis or renal phthisis is a late lesion, that is most frequently encountered by the surgeon. The diagnosis and early treatment of the early lesion of renal tuberculosis may prevent the development of renal phthisis.

3. Renal infection with tuberculosis is through the blood stream. Bilateral infection is the rule.

4. We have not been able to demonstrate a case of excretory bacilluria.

5. Be sure you know that the patient has one sound kidney before the other one is removed. This may require months of observation and repeated animal inoculation of urinary sediment.

6. Renal tuberculosis may end in clinical arrest or cure.

7. Sanatorium treatment is necessary if renal tuberculosis is to be arrested or cured. This is suggested following the surgical removal of one kidney as well as with bilateral infections.

A REPORT OF TWO CASES OF AUTONEPHRECTOMY

E. GRANVILLE CRABTREE

Boston, Massachusetts

It is my wish to report two cases of urinary occlusion of the ureter due to tuberculosis, one of which presents quite unusual features. Kidneys presenting this now well known condition show sufficient variation that the individual case is still worthy of note.

Autonephrectomy does not indicate a uniform type of pathology. The picture presented may vary from the caseated, calcified, completely destroyed kidney, destroyed both in function and histological structure to the intermittently occluded ureter of a pyonephrotic sac. An excellent presentation of this subject, both from the clinical and pathological point of view is given by Caulk (1) in 1915. To Zuckerkandl (2) (1907) goes credit for recognizing the clinical significance of the peculiar atypical forms of tuberculosis described pathologically by Delbert, Küster, Ripin and Kapsamer in earlier years. Zuckerkandl recognized the significance of the pyonephrotic form of occlusion and gave the name "pyonephrosis tuberculosa occlusa" to the condition.

From a study of the various types of lesions produced it is clear that there are several forces at work as the result of progressing tuberculous disease. The final picture produced is dependant upon the relative potency of these several factors.

If the rate of fatty degeneration, caseation and sclerization in the kidney substance outdistances stricture formation in the ureter, sclerotic interstitial degeneration of the kidney is produced, while if occlusion of the ureter is early the pyonephrotic type of lesion is produced. In still other instances the process is incomplete at the time of recognition, resulting in an intermittent type of drainage from a kidney with some slight functional ability and a somewhat active tuberculosis still present. Kid-

neys have been found either at autopsy or at operation in which even septum-like occlusion of a portion of a pelvis had taken place.

Among the factors operating to produce these so-called "spontaneous nephrectomies" resistance of the patient to the disease is a most important factor (Sappington (3)). Slowness of extension both within the kidney itself and protection against invasion of other parts of the body is necessary to allow of such slow processes as caseation, calcification and cicatrization to extend to all the renal and ureteral structures. The time element can only be estimated in a given case from the history obtained and evidence of healed lesion, such as bladder scarring and ureteral retraction. We know that extensive renal destruction can be produced in relatively short spaces of time in the patient of low resistance to the disease. In one case reported by Sappington the estimated age of the lesion was twenty years. Autopsy findings on this case showed only trivial tuberculosis elsewhere in the body. Unless the resistance to tuberculosis is high, it is inconceivable that autonephrectomy could be produced.

Other factors operating to produce renal destruction are those measures (*a*) which tend to spread the disease within the kidney, (*b*) those destructive to the kidney substance, (*c*) those damaging the drainage canals and (*d*) replacement tissues.

Once tuberculosis has reached the kidney it is disseminated either by ascending infection from the pelvis (Ekehorn (4)) or by lymphatics along the true and fatty capsule (Crabtree (5)). If sufficient time can be given through prolonged life of the patient, the whole of the kidney substance will eventually be involved. Lesions from the cortex will extend down into the kidney substance and those arising from the pelvis extend upwards along the tubules toward the cortex.

Of those processes which are destructive to kidney tissue caseation, calcification, and cicatrization are most important. As a result of bacterial growth the tubercle is formed with its centre composed of giant endothelial cells and a surrounding border of protective infiltration cells. Lipoid degeneration takes

place in the area of bacterial growth causing softening of the center and the area of bacterial growth to move back into the protecting wall, thus widening the process. Fatty acids are formed as a direct result of caseation. By the addition of calcium from the blood the fatty acids are split and calcium salts of fatty acids deposited. This leads to calcification of cavernous areas, producing the well known picture seen in x-ray. In still other areas the healing processes so nearly keep pace with the destructive processes that cicatrized areas of tuberculous nephritis result.

Primary tuberculosis of the ureters has been shown by various writers with reports of cases. The primary focus is most common at the site of the anatomic constrictions of the ureter, the one near the pelvis, the other near the bladder. Yet such primary lesions are rare. Tuberculous ureteritis is most often the result of extension from primary lesions in the kidney tissue. Whether primary in the ureter or secondary to the kidney, obliteration of the ureter results from caseation of tubercles, ulceration and fibrosis from the healing processes. Most often this results in stricture formation but often in practically complete obliteration of the lumen over a considerable portion of the course of the ureter.

Obstruction to the ureter in the presence of a tuberculous process in the kidney may produce a hydronephrosis if reasonably sudden or an atrophy. According to Hinman and others, when an infection takes place in a kidney a tendency to anuria exists. Player and Redewill (6) offer two reasons for this: (*a*) The toxins of such infections dampen the sensory impulses to the excretory cells, and (*b*) tuberculous changes in the tissues along the primary bifurcating arteries of the kidney lobules cause a tendency to obliterative endarteritis, checking of the blood flow to the cortex which in turn decreases the output of urine. Such processes result in atrophy of the secreting tissue. If such process is complete before occlusion of the ureter takes place, renal atrophy and not pyonephrosis is the result.

Finally, replacement of renal structures by adipose tissue, while of common occurrence in disease is very characteristic of tuber-

culosis. Caseation and calcification are processes dependent on the lipoids. In some manner as yet unexplained, fat infiltration in tuberculosis takes place rapidly.

As a result of preponderance of one or another of these destructive factors many types of closed lesions have been produced. Among those reported in literature are the following:

The partially destroyed kidney in which a wall of tuberculous tissue closes off a portion of the pelvis leaving the remainder of the pelvis comparatively free from disease. These are rare. Partial nephrectomy as an operative procedure has failed because either through the pelvis or cortical lymphatics, infection extends to the whole kidney or at least farther than it seems.

The closed cavernous type is the most common. This is probably due to the fact that foci are primary in pyramids. Large cavernous destruction of the pyramids eventually rupture into the pelvis, choking a strictured ureter with caseous debris.

Tuberculous pyonephrosis develops on sudden closure of the ureter where mixed infection is present.

Atrophic sclerosed or caseated kidneys undoubtedly are the most chronic in development with occlusion of the ureter developing late.

Obstruction of the ureter where there is only slight involvement of the kidney by disease allows pressure degeneration to outstrip destruction from disease.

As a rule, as in the cases I here report, the kidney shows variations from the above types. Combinations of one or more of these types are sometimes found together.

Of the two cases here reported, the first is my own. The second was operated in the same hospital within the same week by Dr. E. L. Young to whom I am indebted for the case report as well as permission to use it in this paper.

Mr. H. B., aged thirty-one, married.

Patient was referred by Dr. F. Dennett Adams on January 4, 1926. Occupation: inside worker—purchasing agent for contractors. Denies any previous illness other than illness of childhood of which measles, mumps and chickenpox were the only infectious diseases. He had a

knee injury as a boy which was followed by considerable length of time in bed, and some stiffening of the right knee. This knee was not reddened although considerably swollen. He ran no temperature with it and after some months in bed made use of it without any further symptoms developing. There has been atrophy of the muscles of the thigh and right calf. X-ray shows chronic arthritic changes and fixation, but does not suggest tuberculosis.

Three years ago, slight swelling of the testicles all of which cleared up. There has been no history of frequency or nocturia. As far back as he can remember his urination has not been different from what it is now which means the voiding of urine three or four times a day and none at night. The urine has always been clear. On several occasions he has had it examined and has been able to get life insurance without reservations.

Patient's mother was questioned. She stated that the boy as a child had never shown any urinary difficulties more than the other children of the family. She does not remember in childhood that there was any period at which urination seemed painful or urgent. Her family doctor frequently examined the urine up to the time the boy was fourteen years of age, without noting anything abnormal. Patient from childhood has always been athletic and strong. She states that he was her only child who seemed to have few illnesses.

About two years ago, patient noted bloody urine. This came without symptoms and lasted for only a short time. Blood was noticed in the morning, gradually diminishing throughout the day and disappeared. About two months ago, blood was again noted at morning urination and disappeared within twenty-four hours, similar to the first attack. Two days before he was seen in the office, blood again appeared and has continued ever since. There have been no pains referable to the bladder, genitalia, kidneys or abdomen. Action of the bowels has not been disturbed. Patient has been concerned only because of the appearance of blood in the urine.

Examination showed slight nodules of induration of both epididymi. The prostate did not seem abnormal. The urine was very bloody with small clots. Urine examination showed a small trace of albumin, rare mucous shreds, many blood cells and no pus. To determine the source of bleeding, a cystoscope was passed while the bleeding was still on. Prostatic urethra was slightly red and granular. The right side of the bladder and trigone were entirely normal except for slight pink discoloration of the mucous membrane. The remainder of the bladder

seemed normal. The right ureter could be clearly seen, had a clear jet and urine collected from that side was clear. In the normal position of the left ureter, a very dark, discolored area was noted, clearly blood clot and from which fresh bleeding was noted. Attempts to dislodge this blood clot with catheter failed and cystoscopy was discontinued. Patient was then sent into the hospital and cystoscoped again. On rest in bed, the urine had entirely cleared of blood. The dark area previously described had disappeared. It was evidently adherent blood clot. The left orifice could be seen but no jet was seen issuing from it. There was a puckered red stained area just internal to the ureteral orifice which involved the edge of the ureter opening and held the orifice slightly open. Attempt to pass catheters into the orifice failed. The catheter would enter for a distance of 0.5 cm. but could not be made to pass further. Attempt to inject sodium iodine with the catheter in this position failed to show the ureter.

X-ray of the kidney showed the following: There was lobulation of the kidney. It seemed somewhat larger than normal in size, the lobulations being quite prominent such as to suggest either polycystic kidney or kidney tumor. Four other attempts at cystoscopy were made. Finally, by means of a filiform tipped catheter, a narrow stricture of the ureter was passed and a pyelogram on this side obtained. No urine was drained from the catheter in this ureter. Boric solution was injected and recovered. The urine showed no albumin, 4 or 5 red cells and 10 to 15 white blood cells per field. Pyelogram on this side showed marked lobulation of the kidney and a ureter typical of chronic tuberculosis. Function tests were done with phenolsulphonephthalein after intravenous injection. Appearance time on the right was three minutes with an output of 40 per cent in dilution of 250 cc. in fifteen minutes. On the left side, fluid about equal in amount to the boric acid solution injected was recovered from the left ureter in which no color at all appeared. Urine from the right kidney and the wash water from the left kidney and the bladder urine were repeatedly examined for tubercle bacilli by stained slides. Both the right urine and boric wash from the left urines were injected into guinea pigs and both reported negative.

X-ray reports are as follows:

1. "There is considerable gas in the large intestine, which somewhat obscures the kidney outlines. The right kidney seems about normal in size and regular in outline. No definite shadow of stone is seen in the kidneys, course of ureters, or bladder. The catheter was passed well up to the pelvis of the right kidney. The catheter on the left we should

judge was just inside the ureteral opening where it stopped. There was no fluid seen in the ureter and no definite shadow of stone seen at the tip of the catheter, but there is a suspicious shadow at this point which possibly may be a calculus. The left kidney seems large and irregular in outline. It looks more like a lobulated kidney than it does a polycys-

FIG. 1. CASE 1. PYELOGRAM SHOWING LARGE CAVITIES IN THE KIDNEY AND AN IRREGULAR URETER

tic kidney. Would like to repeat these films to try and get a better outline of the kidney."

2. "The right kidney seems normal in size, regular in outline, and there is no shadow of stone in the kidney, course of ureters or bladder. A small shadow seen on the left side low down appears to be about 1 cm. to the outside of the ureter. Pyelogram of the left kidney shows

kidney outline irregular. There is no definite pelvis or calices seen, but the shadow cast by the fluid injected makes three irregular shadows. The ureter is dilated down as far as the transverse processes of the fifth lumbar and is very irregular. We believe this is a destroyed kidney and appears more like a tuberculous lesion than anything else."

Operation was done. An easily deliverable lobulated thin-walled kidney was freed. The ureter was found markedly thickened, and adherent to the peri-ureteral strictures. This thickening continued well down over the brim of the pelvis where it thinned down to apparently a normal sized ureter. At this point it was cut, doubly ligated, cauterized with carbolic acid and the kidney removed. A rubber tube drain was placed to the stump of the ureter. The drain was brought out in the posterior angle of the wound. Wound then closed in layers to the drain. The tube was left in place for ten days, then removed. The wound healed promptly, the sinus closing without difficulty and has remained closed since.

The pathological report is as follows: "Specimen consists of a kidney and ureter. The ureter has a very thick hard wall which encroaches upon the lumen. The pelvis into which it enters is enclosed in masses of fat tissue. Over the surface of the kidney the capsule is definitely adherent in certain areas while the kidney is necrotic and a blackish red in color. On opening the kidney the pelvis is found to be filled with fat and in places where this does not occur there is a caseous fluid purulent material. The cortex of the kidney has been entirely supplanted by smaller cystic areas in which is found caseous material together with purulent material. The kidney itself measures 15 cm. from pole to pole and 6 cm. from the pelvis to the periphery.

"Sections through the kidney show microscopically a chronic infectious pyelonephritis of tuberculous origin. There are numerous large caseous areas with a zone of typical tuberculous granulation tissue. Numerous smaller tubercles are found with giant cells, epithelioid hyperplasia, and lymphocytic infiltration.

"Diagnosis: Tuberculous pyelonephritis."

The pathological report showed that the kidney was destroyed as a functional organ although not undergoing the calcification process so commonly encountered in these kidneys. Functional auto-nephrectomy had resulted. Pathologically, the process was not complete. The patient has made a very satisfactory recovery. When last seen on March 8, had a solidly healed wound. There is a post-operative gain of 20 pounds in weight. The urine is entirely clear of pus and albumin.

Mr. T. K., aged forty-seven, was referred for hematuria.

The patient had been in the United States Army until within the last two years. He had always been well and strong and was then engaged in active labor. It was only by cross-questioning that any history of past urinary difficulty was elicited but on cross-questioning the patient said that ten years before he had had a period of about six months during which he had a great deal of difficulty both by day and by night with frequency, burning and urgency of urination. During this time his urine was very cloudy and he passed blood in small amounts frequently. He lost weight and at one time was in the hospital for study. He thinks at one time that he was about to be operated on for bladder trouble but nothing came of it. He was in the southwest at that time living an active, outdoor life and after about six months of acute symptoms, he gradually felt better so that the symptoms ceased to annoy him. He gradually forgot about it and not until the present illness did he have any further trouble.

About three months ago he had an attack of hematuria which lasted a few days. This happened again about a month ago and again four days before he was seen. Other than the bleeding there are no symptoms referable to the urinary tract. There is no nocturia and no frequency or irritability by day. The patient is now working and is in good general condition.

A careful general physical examination fails to reveal any trouble anywhere. The urine showed at first blood and nothing else abnormal. The special examination done when he was referred for study showed no tenderness over either kidney, ureter, or bladder. The kidneys were not palpable. Cystoscopy easily done. The bladder is not irritable, there is no enlargement of the prostate, the right ureter easily catheterized with no obstruction and a good flow of normal appearing urine. The left ureter shows a slight amount of redness around the orifice and a catheter will not go more than a few centimeters into the opening. Even a small, bougie tipped catheter failed to do more than engage. Specimens of urine taken by catheter showed a few red blood cells, an occasional pus cell, no growth, and a microscopic hunt for tubercle bacilli was negative.

X-rays show "a large dense mass in the left flank with numerous fine calcified areas scattered about it like tuberculous calcification. The right kidney is fairly large, of normal outline. Just below it, out from the fourth lumbar vertebra are some calcified glands. Down in the left flank is a calcified mass that might be a stone, and above it on the right

in the pelvic plate is a large calcified gland. It is hard to tell whether the mass in the left flank is a kidney or spleen as both fuse."

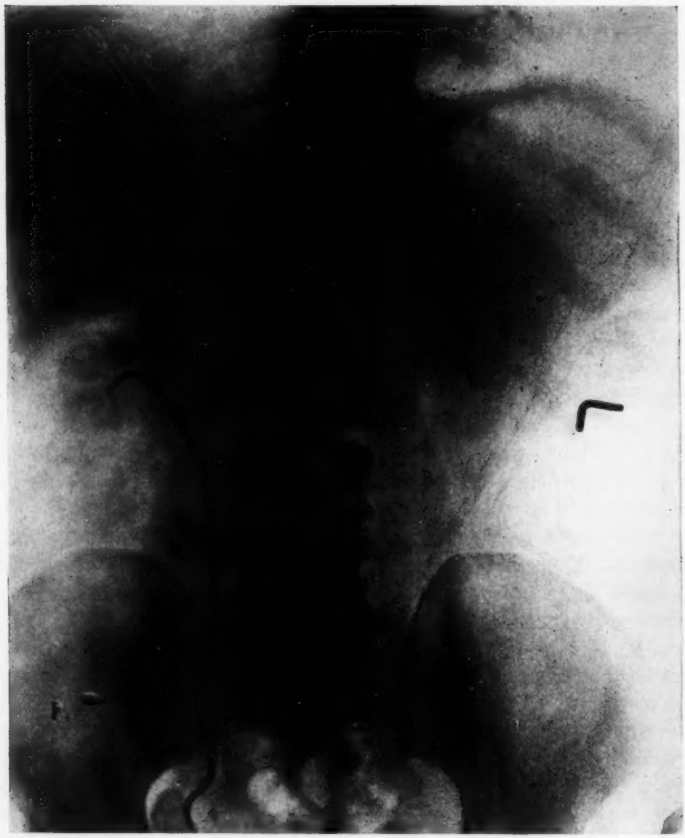


FIG. 2. CASE 2. X-RAY FILM SHOWING SMALL DENSE KIDNEY ON THE LEFT
Note the large calcifications in the pelvis about the bladder

With this evidence of old tuberculosis, a further study was done. The patient was again cystoscoped and the right ureter catheterized, and further attempt made to catheterize the left ureter. This was again

impossible to do. Stereoscopic x-rays were taken with an x-ray catheter engaged in the ureter which showed that the calcified mass mentioned as low down in the left flank was certainly not in relation to the ureter. A split function was then done with phenolsulphonephthalein using a large catheter in the right ureter for that side and the bladder as representing the left side. This showed a normal function from the right and no function from the left. The urine from the right side showed no pus and no infection. Accordingly, one month after patient was first seen, another attempt was made to get into the left ureter. This was likewise unsuccessful, and as the patient had been prepared, an immediate operation was done.

An oblique kidney incision was made. The perirenal fat was not abnormal. A small nodular kidney was uncovered which showed at one pole an area suggesting an old, partly calcified abscess. No definite pathology was identified. The blood supply seemed to be almost lacking although there were three places which were tied which might have contained small blood vessels. The ureter was thickened, freed nearly to the brim of the pelvis and cut. An attempt was made to catheterize at the cut end, but nothing could be made to engage although there seemed to be a lumen. The wound was closed around a small rubber tissue drain. The wound did very well although it drained for sometime as these tuberculous wounds are apt to do. On the third day the patient had a small pulmonary embolus which made him fairly sick for six days but other than that he made a normal and complete convalescence.

The kidney was about one-half normal size. When split it showed that it was composed mainly of fibrous and fatty tissue. The greatest dimension of the kidney was only 6 cm. and there was nothing left of actual kidney tissue, it being largely replaced by the fibrous and fatty tissue mentioned. At one pole there were two large abscesses which contained caseous material. On smear, no tubercle bacilli were found. The microscopic examination showed much hyaline material with practically all of the glomeruli and tubules replaced by scar tissue. Much round cell infiltration. Pathological report was tuberculosis.

REFERENCES

(1) Caulk, John R.: Occluded renal tuberculosis. Trans. Amer. Urol. Assoc., 1915, ix.

(2) Zuckerkandl, O.: Die Geschlossene Tuberkulose Pyonephrose. Zeitschr. f. Urol., 1908, ii.

(3) Sappington, S. W.: Case of massive tuberculosis of the kidney. Jour. Amer. Med. Assoc., 1921, lxxvii, 525.
(4) Ekehorn: Die Ausbreitungsweise der Nierentuberkulose, in der tuberculose Niere. Fol. Urol., 1908, ii, 412.
(5) Crabtree, E. Granville: The rôle of the cortical lymphatics in the extension of tuberculosis within the kidney. Arch. Surg., 1920, i, 815.
(6) Player, Lionel P., and Redewill, Francis H.: Autonephrectomy. Jour. Amer. Med. Assoc., 1926, lxxxiv, 17.

DISCUSSION

Dr. Edward L. Keyes (New York): Dr. Thomas' conclusions seem to be founded, if I have understood him correctly, upon pathological evidence satisfactory to him that the lesion of tuberculosis in the kidney may, and does, heal.

I did not understand him to allege that he had ever seen a specimen of a kidney in which all of the tuberculous lesions had healed without autonephrectomy, so-called. All of us have known clinical and pathological evidence of temporary healing of renal tuberculous lesions.

I have known a patient to remain clinically well for six years after his initial hemorrhage, before he had a relapse of symptoms, and I took his kidney out, to find the upper half of it cheesy.

I have known a patient with more active tuberculosis, sufficient to put pus in the urine, to become well and remain well for three years.

Dr. Bugbee has reported similar cases, and many others have done the same.

Even skin lesions of tuberculosis always show healing in spots, and the scar that is seen by all of us, in every lesion of tuberculosis, shows healing of a sort.

To delay operation ignores the usual progress of the disease to the terrible cystitis, with which we are all familiar, and even bilateral cases may do well—heal, if you insist upon using that word which I do not like—if the second kidney is given the opportunity to heal by nephrectomy and removal of the gross lesion in the obviously actively diseased kidney.

Dr. William A. Frontz (Baltimore): I should like to ask Dr. Thomas whether in the cases in which the urinary findings were negative the guinea pig test was always employed, because unless this test is used I feel that certain cases will be missed.

I have had a case recently which has offered a certain amount of difficulty to me. A young man presented himself with an extensive infection of the genital tract, one epididymis involved, both vesicles, and a most extensive involvement of the prostate. Studies of his voided urine showed microscopically myriads of tubercle bacilli, and we suspected, of course, an upper tract infection. On cystoscopy, however, his bladder was perfectly normal in appearance and both ureteral orifices were normal. Urine was obtained from each kidney and injected into pigs. The urine from the left kidney grew out positively. The pig died in fourteen days and showed very extensive tuberculous lesions.

Six weeks later the ureter was again catheterized and pigs were injected with negative findings. I was rather inclined to interpret these first findings as the excretion of bacilli through the healthy kidney. Of course, it is well known that the kidney, in the case of typhoid, constantly is excreting large numbers of organisms, and my impression has been that the healthy kidney can secrete tubercle bacilli.

I should like to get the opinion of some of the other members on this point.

Dr. ARTHUR L. CHUTE (Boston): I wish to compliment the writer on his paper. It seems to me a very interesting and important contribution.

In a paper, largely hypothetical, that I read in New York several years ago I gave my reasons for believing that both kidneys must of necessity be infected in most instances of renal tuberculosis. I did not, however, have the pathological proof of this probability that Dr. Thomas has set forth in this paper. The probability of the accuracy of this view is heightened by my experience that a number of patients from whom I removed a tuberculous kidney some eight, ten, or twelve years ago for what was at that time so far as we could determine an involvement of one kidney, are now coming back with a lesion on the other side. There have been two or three cases of this sort within the last few years. To my mind it is quite as reasonable to suppose that an old quiescent focus in the supposedly well kidney has lighted

up, as to suppose that there has been a recent infection from the original focus of tuberculosis.

I believe there is no question but that we must bear in mind this possibility of lesions in both kidneys when we can find evidence of this in but one side, and it seems to me perfectly possible that it may be necessary to modify the dictum that "we must remove a kidney as soon as we recognize it as tuberculous." We must differentiate between what you might speak of as a medical tuberculosis of the kidney and a surgical one. I do not believe all tuberculosis of the kidney is immediately and invariably surgical: I believe some of the early cases undoubtedly must get well.

One point that I think we should make clear is that we do not take out a kidney merely because it is a focus of tuberculosis, at least I do not do so. My conception of the situation is that we take out a tuberculous kidney because experience has shown us that if we do not the tuberculous process will extend to the bladder, and a tuberculous bladder is a most trying condition, if the involvement of the bladder is allowed to become deep, the patient may never be comfortable gain. I do not believe that every time we find tubercle bacilli in the urine and find that they come from a given kidney that we should remove that kidney at once. If the lesion is small and the bladder not involved, we can well wait a time to see if nature can take care of it. I do not mean by that we should wait until the bladder becomes involved but I do believe it is time for us to change our opinion that the finding of a few tubercle bacilli in a renal specimen demands the immediate removal of that kidney.

In connection with Dr. Crabtree's paper, I remember very well a patient whom I saw quite a number of years ago who had a history of urinary trouble several years before, followed by a period of comfort and a clear urine: when she came to me the complained of discomfort in her right side; her urine was clear; she had no bladder symptoms but she did have a thickened ureter and a kidney that was absolutely shut off from her bladder. I removed an entirely destroyed tuberculous kidney with relief to her symptoms.

Dr. WILLIAM F. BRAASCH (Rochester, Minn.): The essayists, and Dr. Thomas in particular, are to be commended for their excellent papers. I am glad that they have again called our attention to the difficulty of diagnosing early renal tuberculosis. Any urologist can diagnose the late forms of renal tuberculosis, but the early forms offer problems which may be very difficult to solve. We cannot rely upon any one form of examination; it is necessary to employ them all. In other words, a pyelogram alone may not tell the story, neither may guinea pig inoculations, repeated microscopic slides nor cystoscopic examinations. Every clinical datum, remote and at hand, may be necessary in order to diagnose these early cases of renal tuberculosis, and they offer us the greatest problem we have in diagnosis in urology.

As far as incidence of bilateral renal tuberculosis is concerned, it would be very difficult to prove the existence of bilateral infection in the early stages, and the problem will always remain largely hypothetical.

It is frequently necessary to rely largely upon guinea pig inoculation in the clinical diagnosis of bilateral renal tuberculosis. Dr. Beer and his associates have called our attention to a very practical point in employing guinea pig inoculation in the diagnosis of bilateral renal tuberculosis, namely, that we can have renal tuberculosis in one kidney and have positive guinea pigs from the urine in the other kidney without any tuberculosis being present in the second kidney. The positive test is due to reflux from the bladder up into the well kidney from which the positive inoculation occurred.

Therefore, if the guinea pig inoculation from the supposedly well kidney is positive, even though a few pus cells are present in the ureteral specimen, if the function of that kidney is normal, we can usually ascribe the positive inoculation to reflux or possible contamination from the catheter, ignore it and remove the definitely tuberculous kidney.

That we are correct in this attitude had been proven by a review of a number of cases in the last five years, where in the course of routine bilateral guinea pig inoculation there was a positive guinea pig return from the supposedly well kidney. Such patients have

been reported well, with normal urine, and apparently cured, as far as any usual clinical examination can disclose. We must come to the conclusion that while it is true that some of these patients had actual bilateral renal infection, spontaneous recovery could hardly occur in every case.

It is evident, therefore, that while guinea pig inoculations are invaluable in the diagnosis of renal tuberculosis, they may be too delicate a test in certain cases, and misleading. Early bilateral infection may be exceedingly difficult to diagnose clinically.

Dr. ALEXANDER RANDALL (Philadelphia): May I ask Dr. Thomas if he is in concurrence with Halle's original work along this line: that it is the closed parenchymatous renal tuberculosis which goes on to healing, and it is the open pyelitic, as he called it, ulcerative renal tuberculosis that enters the surgical field and demands nephrectomy?

Halle's original conception of the healing of these cases was that it was only these cases like the one Dr. Keyes was citing, where there is a closed lesion, that do heal, and that the borderline between surgery and medicine lies at this point.

Dr. GILBERT J. THOMAS (Minneapolis): Concerning Dr. Keyes' discussion, I think we are in perfect agreement. We do not say that large destructive or surgical lesions of renal tuberculosis heal. If there was healing in this condition, urologists recognize it and we would not have to ask the pathologist about it. We do say however that tiny lesions of renal tuberculosis may heal. We also believe that clinically proved lesions of tuberculosis that may be visualized with the pyelogram are arrested.

We divide tuberculosis into the early lesion and the late lesion, medical and surgical, if you want to use these terms.

We have sent Medlar a number of our specimens for examination because he has developed a good technique for sectioning. Our figures indicate that it would take us three years to serially section one kidney.

It will pay us to take the time to read about Medlar's work concerning renal tuberculosis. I hope we will be able to induce

Dr. Medlar to attend our meeting next year, at which time he will have examined a sufficient number of human kidneys, so that he may give us the result of his late work on tuberculosis of the kidney and the pathology of tuberculosis elsewhere in the body. This is a wonderful piece of work and includes entirely new facts concerning the pathology of tuberculosis.

Medlar has been able to show in his microscopic specimens definite healed lesions of tuberculosis. There is nothing in the cellular pathology of the healed lesion which identified it as being tuberculosis, however in the same section one may find healed lesions and tiny destructive ones that may be identified as tuberculosis. In the same kidney he will find different grades of healing and different grades of destruction. So that Medlar assumes, that the scars which he finds in tuberculous kidneys are the result of healing of tuberculous lesions. I think Dr. Medlar is right.

I say do not operate because you find tubercle bacilli on one side. I feel that renal tuberculosis is always bilateral. Because you find tubercle bacilli on one side and are not able to demonstrate destructive lesions such as Dr. Keyes was talking about, do not operate on the patient right away. I think it is just as important to rest a patient with a tuberculous kidney as one with a tuberculosis lung. I believe that an occasional lesion may be arrested. I have one or two that have healed, as far as clinical and pyelogram observations are concerned.

Dr. Frontz asked about the urinalysis. Every one of our patients' urinary sediment is injected into guinea pigs many times. Two pigs are always used.

The importance of this research problem under the present conditions is that we have the patient in the hospital for three, four, or five years. We are able to cystoscope these patients every six or seven weeks, and many have repeated guinea pig tests.

Our urinalysis consists of the injection into one pig of the sediment from six separate urine specimens, two of which have been anti-forminized, so that we employ all the techniques we know about so that we will not miss the organisms.

Dr. Braasch spoke concerning the finding of tubercle bacilli on one side and not on the other. I think there again our op-

portunity of repeatedly examining these people time after time increases the number of bilateral infections that we see.

Concerning Dr. Randall's question. We do not find the open lesions are the ones that do not heal and the closed ones the ones that do heal. When you have a destructive lesion, I do not believe either the open or the closed heal. We are talking about the early renal lesions of tuberculosis, that do not show gross destructive lesions; those early renal lesions are the ones in which we can really demonstrate microscopic healing.

Dr. NATHANIEL G. ALCOCK (Iowa City): I want to say that I think it takes a great deal of what you might call "intestinal fortitude" to discuss this subject in the way that Dr. Thomas has discussed it, but I want to explain something of Dr. Medlar's stand in this matter.

His work has been unusually carefully done, and I do not believe that we can fail to accept his results.

What has he proved? He has proved for us experimentally, I believe for the first time, that we cannot say that a kidney is negative for tuberculosis through which tubercle bacilli have come until it has been serially sectioned and every section examined by a man who is competent to pick up the changes.

The second thing he has proved, for the first time, is that a kidney cannot excrete organisms—tubercle bacilli—without showing lesions. We have all held that as a truth. I think he has proven it now.

Medlar goes farther than that. He does not believe that a typhoid bacillus can go through a kidney without producing a lesion, and he says the only way that you can prove they can go through without producing damage is to take the kidneys when they are excreting them and make serial sections and examine every portion of every section. I think his ground is well taken there.

Medlar does not hold anything that will change our ideas on indications for nephrectomy. For instance, he says if the lesion is large enough to be what we call a surgical lesion, it is not going to heal.

For instance, I had a patient with a tuberculous epididymitis. We routinely cystoscope those cases, catheterize the ureters and inject guinea pigs. This one was catheterized three times; the patient had a negative bladder and negative urine from both kidneys for pus, and tubercle bacilli by the smear; three guinea pigs from the left kidney were positive. I took out that kidney.

It just happened that when the patient was in the hospital, Dr. Cabot was giving a clinic. I presented this case to him. He went over the history and he said, "Why did you take out that kidney on the three positive guinea pigs alone?"

I took out that kidney, even though it looked absolutely normal. I cut the kidney open after I got it out, and cut it five times before I found an abscess as large as a pea.

Dr. Medlar was our pathologist at that time. A year ago I referred him back to that case and I said, "Medlar, if you had known that that lesion was in that kidney, would you have had me take that out?"

He said, "Yes."

But Cabot asked me why I took it out.

Now I have another case, exactly the same thing, where I have a negative bladder; negative urine from both kidneys for pus and for tubercle bacilli by the smear; bilateral tuberculous epididymitis. I have had the three guinea pigs from the left kidney positive. The function of that left kidney is as good as the right. Would you take out that kidney? Medlar has changed me to the extent that I am waiting.

I do not want you to get the wrong idea as to what Medlar is doing. He is not holding that a surgical kidney will become cured, but he has shown in his sections that tuberculosis of the kidney will heal. Whether all of them will heal or not, I do not know.

Dr. Edward L. Keyes (New York): Was not the abscess in the kidney first mentioned a surgical lesion, the one that you took out in Cabot's honor?

Dr. ALCOCK: It was an abscess, but I did not know it was. It was a surgical lesion. In the clinical diagnosis, all he had was tubercle bacilli coming through there, no pus. How are you going to tell the difference?

Dr. KEYES: You made a rotten diagnosis but gave him good treatment. (Laughter).

UNUSUAL CASE OF TUMOR IMPLANTATION FOLLOWING NEPHRECTOMY FOR PAPILLARY CYST-ADENOMA

WILLIAM A. FRONTZ

From the James Buchanan Brady Urological Institute, Johns Hopkins Hospital

The following case is considered of interest in that following nephrectomy for renal papillary cyst-adenoma there developed in the abdominal musculature a tumor which was identical histologically with the neoplasm found in the kidney. The condition was regarded as the result of implantation of tumor cells occuring at the time of the nephrectomy, despite the fact that the kidney was apparently removed without contamination of the operative field. The tendency of ovarian tumors of this type to become implanted on the peritoneum is well known. This sequel to operation, however, is not common with the kidney because of the usual extraperitoneal approach. In our series of cases the one herewith reported is quite unique.

The patient sixty years of age was first admitted to the clinic October 26, 1921, at which time he gave a history of hematuria which was first noticed three weeks before. This bleeding was associated with slight discomfort in the region of the left kidney, being most marked immediately preceding the appearance of blood in the urine. The urine was free from blood at the time of admission and cystoscopy revealed numerous fine polyps around the vesical orifice which in our opinion were probably the source of the bleeding. The polyps were fulgurated and apparently destroyed.

The patient returned to the clinic in April, 1922, stating that blood clots had been passed in the urine at frequent intervals since the previous October. On cystoscopy at this time it was found that the vesical polyps found during this examination five months before had

disappeared. The bladder looked perfectly normal, but issuing from the left ureteral orifice was a steady stream of blood. Both ureters were catheterized; the urine from the right being normal while that from the left contained blood. A left pyelogram was done which

FIG. 1. PYELOGRAM SHOWING FILLING DEFECT IN UPPER CALYX

showed a peculiar filling defect in the upper calyx. A diagnosis of papillary carcinoma was made and nephrectomy advised.

At operation of April 24, the kidney was removed. On longitudinal section, its upper half was found to be replaced by a large tumor mass which was covered by a very tough and dense fibrous capsule which

measured from 2 to 3 mm. in thickness. The surface of the kidney in its upper half was quite smooth, except for several large nodular elevations and was everywhere intact. On the cut surface a fibrous tissue framework divided the tumor into lobules which were filled with many

FIG. 2. GROSS SPECIMEN OF KIDNEY

grayish-yellow irregular friable papillae. No definite cysts were seen in the gross specimen. The renal pelvis was small and its upper half filled with tumor tissue.

Sections taken from different portions of the tumor gave a microscopic picture, which was quite typical of papillary cyst-adenoma.

Large cyst-like structures, many of which were almost completely filled with papillary projections were found. These papillae had a very fine connective tissue axis which was covered with two or three layers of cuboidal cells. The cells showed a considerable degree of variation in the size and shape but the variation in the staining of the nuclei was not particularly marked as most of them were pyknotic. The patient's post-operative course following nephrectomy was quite uneventful and he was discharged from the hospital five weeks after operation.

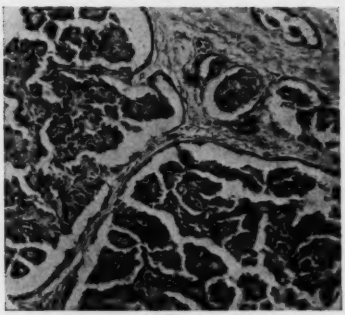


FIG. 3

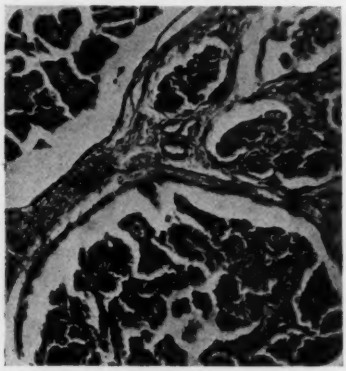


FIG. 4

FIG. 3. PHOTOMICROGRAPH SHOWING LOW POWER VIEW OF SECTION TAKEN FROM UPPER POLE OF KIDNEY

FIG. 4. PHOTOMICROGRAPH SHOWING LOW POWER VIEW OF RECURRENCE

He returned to the clinic on March 9, 1926, with the statement that for three years following nephrectomy he was without symptoms. During the past ten months, however, he has noticed more or less lameness and soreness along the entire length of the nephrectomy scar. This discomfort was periodic but the severity of the pain has been progressive. At times it would be quite marked and would radiate into the left testis. Three weeks before admission he noticed a small tumor mass below the operative scar.

On examination the nephrectomy wound was well healed. Just anterior to the lower extremity of the nephrectomy scar and in the mid-axillary line a hard and somewhat irregular mass measuring about

5 cm. in diameter could be picked up. This mass was roughly spherical in outline and movable under the underlying tissues. The condition was regarded as tumor recurrence and operation advised. At operation on March 10, 1926, the tumor was found to involve the external and internal oblique and the transversalis muscles. The peritoneum was not involved, the transversalis fascia acting as a barrier to the downward extension of the tumor. The tumor was excised with a wide margin which sacrificed most of the muscle lying between the costal margin and the iliac crest. It was possible, however, to obtain a satisfactory closure and at the time of the patient's discharge two weeks later, no break in the muscles was evident.

Microscopic section of the tissue removed gave a picture which is practically identical with that noted in the tissue removed from the kidney four years before.

REPORT OF A CASE SHOWING EXTENSION OF PYELOGRAPHIC MEDIA BEYOND THE CALYCES

MONTAGUE L. BOYD

Atlanta, Georgia

Cases showing at pyelogram an extension of sodium bromide or sodium iodide into the kidney substance beyond the calyces are, in my experience, very rare. Herman's case reported in the February, 1926 number of The Annals of Surgery is the only roentgenogram I have seen published.

This case is of interest, therefore, on account of its rarity as well as because of the difference of opinion which has existed as to the channels through which such extensions have taken place.

J. T. C., married, aged forty, railroad flagman, was sent to me by Dr. J. A. Johnson, of Manchester, Georgia, April 17, 1925. His only complaint was blood in the urine.

Past history. He had had typhoid fever eight years, and "flu" two years, before I saw him. He drank three or four cups of coffee a day and smoked twenty cigarettes.

Three teeth were pulled three years previously. The urological history was completely negative.

Present illness. For two years he had been getting up once at night to void. For five months he had passed blood in the urine; not constantly but a good deal of the time during the first month, and constantly for four months. The blood was a dark color, always mixed with the urine, and no clots were seen. No pains, or other symptoms of any kind, except a slight increase in the frequency of urination—rarely more than once at night, however. He had had no gastro-intestinal symptoms, no chills and fever, in fact no other symptoms of any kind.

Height, 6 feet 1 inch. Weight 145 pounds for fifteen years.

Examination. Showed a negative genito-urinary tract, except a left renal hematuria discovered by cystoscopy. An 11 F. Garceau catheter was tight in the left ureteral orifice at 3 cm.

The upper part of the abdomen on the left was somewhat flattened, due to a flattening of the lower part of the chest on that side which had existed since infancy. The right side of the chest was also a little flattened but not as much as the left. The right kidney was a little too low, but otherwise normal.

Four months later he returned for further examination. He had passed blood in the urine continuously since I had seen him last.

A 7 F. ureteral catheter passed readily 20 cm. up the left ureter where it was stopped. The pelvic capacity on the left side was 15 cc. of normal salt solution; with that amount a slight discomfort was produced which subsided immediately. An intravenous phthalein test showed an appearance time of eight minutes on the left through the ureteral catheter, with an output of 12 per cent in sixteen minutes; from the right kidney, through a urethral catheter, 33 per cent in twenty minutes.

Pyelogram. For the first roentgenogram 13 cc. of a 15 per cent solution of sodium iodide were injected through the ureteral catheter and caused a good deal of pain. A second roentgenogram was made with a similar injection after the fluid injected first had been allowed to run out through the catheter.

Seven days later another pyelogram was done like the one above described, except that a third injection was made with the patient lying flat. Very little pain was produced this time by the injection of the sodium iodide and he suffered no subsequent inconvenience whatever. However, following the first pyelogram, he had some pain and soreness and some nausea for eighteen to twenty hours, but he only had one hypodermic of $\frac{1}{6}$ grain of morphine. In twenty-four hours he was seemingly all right, though for three days he had a little fever in the afternoon—about 0.5 degree.

Another intravenous phthalein test, done a day after the last pyelogram, with a Garceau catheter in the right ureter showed 12 per cent of dye from the left side in eighteen minutes, and 33 per cent from the right side in twenty-two minutes.

Description of the roentgenograms: The ureterograms show a kink in the left ureter which lies over the outer part of the fourth lumbar vertebra. It is constant in all the roentgenograms; in some the tip of the catheter is evidently stopped at the kink, in others it has been withdrawn, but the kink persisted. The ureter is not dilated, and none of the sodium iodide seemed to have run back into the bladder.

The roentgenograms showed a satisfactory filling, but no abnormalities in the kidney pelvis or calyces, except an extension of the sodium

iodide solution outward through the cortical substance as far as the capsule. This was most marked with the second injection made at the

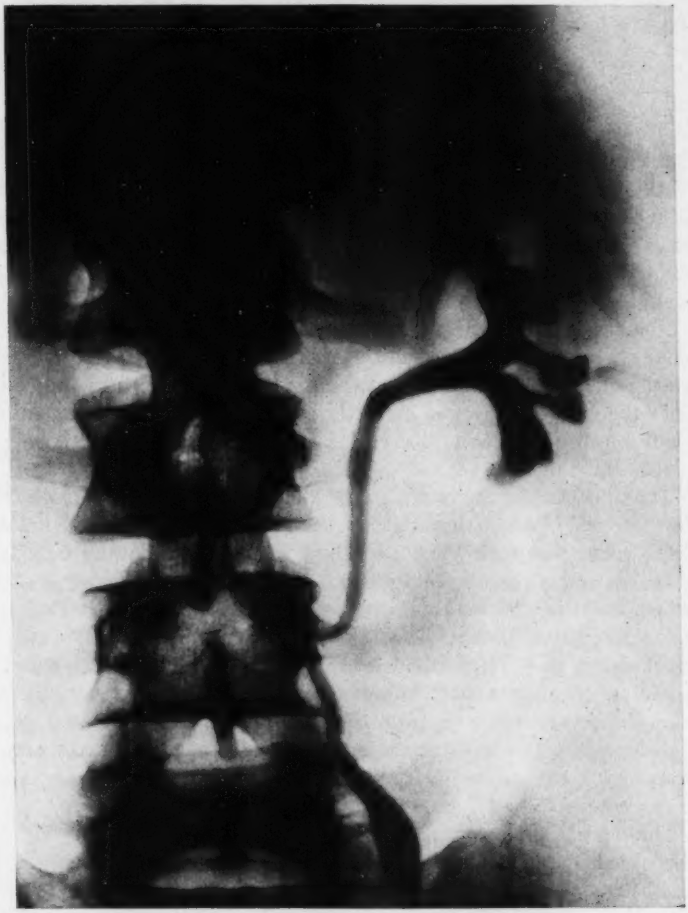


FIG. 1. SHOWING THE SHADOWS OF THE SODIUM IODIDE IN THE MEDULLARY AND CORTICAL ZONES OF THE KIDNEY

second pyelogram when 13 cc. of a 15 per cent solution of sodium iodide was injected with the patient recumbent.

There are three major calyces. The extension of the iodide is most marked from the upper calyx, less marked from the middle calyx, and only two narrow lines are seen extending from the upper minor calyx of the lower major calyx. The shadows of the extensions in the upper part of the kidney are pyriform, the outer, wider part measuring 1.5 to 2 cm., and they extend as far as the outline of the shadow of the kidney. A roentgenogram made at the last pyelogram, when the kidney was injected twice, each time with 13 cc. of sodium iodide, and the iodide then drained out, shows no shadow of sodium iodide in the kidney.

August 12, 1925, nine days after the first pyelogram and two days after the second one an exploratory operation on the left kidney was done because of the bleeding, the lowered function of that kidney, and the unexplained kinking of the left ureter over the fourth lumbar vertebra.

At operation I found several scattered nodules on the surface of the kidney which looked like small dark hematoma. They did not bleed when punctured. The kidney otherwise did not look abnormal, but since the right kidney was perfectly good and I could not explain the condition which I had found, I decided that a nephrectomy was advisable.

The upper ureter below the pelvis was found to be a little more fixed than normally, but no investigation to discover the cause of the kinking of the ureter was made since the kidney was being removed.

Description of pathological specimen. The size of the kidney is about normal and there are no abnormalities in shape. On the ventral surface at the juncture of the middle and lower thirds are two slightly elevated, bluish areas, well defined and firm. They measure 1.3 and 1 cm. in diameter. Scattered over the surface of the kidney are numerous other similar areas varying from 0.2 to 0.5 cm. in diameter. On section, these areas are seen to extend into the kidney about 0.3 cm. and extend at most 0.2 cm. above its surface, while the largest one, mentioned above, extends about 1 cm. into the kidney.

The patient's recovery from the operation was uneventful. He was discharged from the hospital on the fifteenth day, and has been in good health ever since.

In May, 1926, he had gained weight, felt perfectly well and was free from any urinary symptoms.

It would seem evident from the conclusions reached by J. M. Mason (1) in 1914 that the condition I found in this kidney

was the result of an extension of the pyelographic media into the tubules. He reported two cases and reviewed the literature up to 1914 in which other similar cases were reported. Since the pyelographic media employed at that time was collargol, it was possible to observe the collargol in the kidneys removed at nephrectomy and to demonstrate it in the tubules, and glomeruli and in the hemorrhagic nodules which were seen on the surface of the kidney in many of these cases.

Hinman (2) in his article on "Pyelovenous back flow" demonstrated the possibility of the extension of pyelographic media and other solutions into the venous circulation, but was unable to discover any extension into the tubules. He says, "Injection of the deeper renal tubules is impossible by way of the ureter, and parenchymal extravasation requires intrapelvic pressure probably never produced clinically."

It may be possible, as Hinman says, that the collargol found in the tubules in Mason's cases, and those of others, was the result of secretory processes. But there still remains to be explained the method of formation of the nodular infarcts found on the surface of the kidney in many of these cases. Mason showed that there existed in some cases (Mallary's and Tennent's) definite wedge shaped areas of tissue infiltrated by collargol, extending from the cortex to the pelvis. He concluded from his observations that the collargol could ascend into the tubules and out into the surrounding tissues. On the other hand, Hinman was unable to inject the upper part of the tubules even when he employed a great pelvic pressure.

In my case the areas of extravasation seem limited to the outer corticle zone. A microscopic section through one of the nodules seen on the kidney surface shows an extensive extravasation of blood cells into the connective tissue. The glomeruli and tubules seem very little injured, and central to this area of extravasation the renal tissue seems fairly normal.

It would appear evident that these changes which I found in the kidney were produced by the injection of the kidney with the sodium iodide, since the roentgenograms show the solution

extending out into the cortical area, and since they correspond to the lesions found in some of the cases collected by Mason.

A study of the pathological specimen alone does not lead us any nearer to a solution of the problem of whether the lesions were produced by an injection of the tubules or by pyelovenous back flow.

On the other hand, the shadows of the injection of the medullary and cortical zones seen in the roentgenograms are quite different from the illustrations of the roentgenograms showed by Hinman in pyelovenous back flow, where the injection seems to be diffuse rather sharply limited, as they are in my roentgenograms, to a piriform area with its apex at a minor calyx. Perhaps this can be explained by the difference in the anatomical structure of the human kidney from that of the sheep's kidney used by Hinman. However, until further evidence to the contrary is advanced, I am inclined to believe that the extension of the sodium iodide in my case occurred by way of the tubules.

REFERENCES

(1) Mason, J. M.: Dangers attending injections of the kidney for pyelography. Jour. Amer. Med. Assoc., March 14, 1914, lxii, no. ii, 839.

(2) Hinman: Jour. Amer. Med. Assoc., February 23, 1924, lxxxii, 607.

STUDIES IN THE COMPOSITION OF URINARY CONCRETIONS WITH A REPORT OF SOME INTERESTING MANIFESTATIONS OF CALCULOUS DISEASE

JOSEPH F. McCARTHY AND JOHN A. KILLIAN

Departments of Urology and Bio-Chemistry, New York Post-Graduate Medical School, New York City

Female, unmarried, age twenty-eight at the time of coming under the observation of one of the writers, about three years ago. There is nothing of note in her history until ten years prior to this period when she was thrown from sleigh, thereby sustaining an indefinite injury to her back. This injury was immediately followed by complete urinary retention. In an attempt at catheterization by her family physician, she suddenly voided under great force, a stream of bloody urine. Pronounced cystitis with complete retention supervened and remained more or less constant for a period of six months. At that time she entered the New York Post-Graduate Hospital, was studied in the Gynecological Department, following which she was referred to the Neurological Hospital for possible cord injury. Both institutions reported negative findings. She then returned to the Jamaica Hospital, L. I., subsequently coming under the observation of Dr. Francis G. Riley of that city. From that time up to three years ago she has had five suprapubic cystotomies for removal of calculus. For the past few years there have been removed, by open operation and cystoscopic procedures, in all 219 stones.

During the foregoing period she has had numerous cystoscopic examinations, renal functional tests, pyelographic studies at the hands of competent urologists. In all of these studies there has been observed nothing indicative of renal origin or the passage of calculi from above. During the numerous cystoscopic observations of this patient, Dr. Riley had noted and called one of the writer's attention to the fact that these stones while small, seemed to have a common location in the bladder. They were imbedded uniformly in a well defined area of papillary edema until they had reached sufficient size apparently to drop off and become free on the floor of the bladder. This observation was confirmed by us on a number of occasions.

Figure 1 shows a very small stone imbedded in this area seen from some distance away. Figure 2 shows a larger stone with a closer view. Figure

FIG. 1

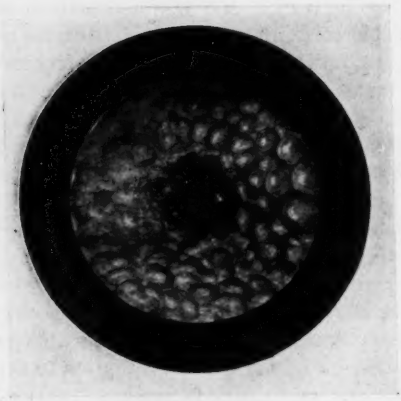


FIG. 2

3 a close-up picture of stone imbedded in this area of papillary edema. During a period of daily cystoscopic observations, we have noticed what

seemed to us the birth of some of these minute stones, the sizes of which will be noted later.

Our curiosity was naturally aroused by this unusual case, and we came to the same conclusion that would ordinarily be reached, especially in view of the very dense x-ray shadow cast by the stones as well as the accidental finding of a considerable percentage of iron, that there must have been some artificial means of introduction of the same. This viewpoint, however, was we felt, negatived by their situation, by the presence of this edema and by the fact that we had this individual under the closest observation during a considerable period as a bed patient,

FIG. 3

notwithstanding which these minute stones seemed to form in the edematous area previously mentioned, which was postero-mesial to the left ureter. It was then decided to make a comprehensive study of the ultimate chemistry of such stones as we could gather for examination. On the insistence of Dr. Riley, we were induced to perform an excision of this edematous area hoping thereby to remove the underlying cause for the formation of these calculi, with the result that for a period of six months following the excision of this edematous tissue there was a complete remission of all symptoms. And whereas, prior to this operation stones had formed, at times from one to as high as three within a

TABLE 1

Vesical calculi from C. B. from September, 1925, to April, 1926

DATE	NUMBER OF CALCULI	COLOR	DIMENSIONS	WEIGHT	REMARKS
			mm.	*grams*	
9/24/25	2	Mottled brown and white	12 x 9 14 x 8	2.3	Removed under general anesthesia
10/16/25	4	Gray	2 x 2 x 2	0.10	1 passed, 3 removed
?	3	Brown gray	1 x 1 x 1 1 x 1 x 2 3 x 2 x 2	0.05	2 passed 1 removed
12/12/25	2	Brown and white	3 x 3 x 3 5 x 3 x 3	0.15	Removed
12/19/25	3		5 x 4 x 3 4 x 3 x 4 6 x 4 x 3	0.20	Removed
12/22/25	2	Dark gray Light brown	3 x 3 x 3 4 x 3 x 3	0.10	Removed
12/26/25	2	Gray	4 x 4 x 3 2 x 3 x 2	0.10	Removed
12/31/25	3	Dark gray	3 x 2 x 3 4 x 3 x 2 3 x 3 x 2	0.09	Removed
1/ 8/26	3	Dark gray	5 x 4 x 4 6 x 7 x 5 4 x 4 x 3	0.40	Removed
2/15/26	None				Cystoscopic examination
2/20/26	2	Brown gray	6 x 4 x 3 5 x 3 x 3	0.25	Removed. Formed during 5 days
3/11/26	2	Dark gray	8 x 6 7 x 5	0.35	Removed
4/ 5/26	1	Dark gray	4 x 3 x 3	0.12	Removed
4/20/26	1	Brown gray	3 x 3 x 2	0.08	Removed
Total...	30			4.29	

period of a week, there was no reappearance of stone during this six-month period. The patient enjoyed complete comfort, and we felt an unusual cure had been accomplished in an unique case. At the end of this six-month period stones began to reform in the bladder, and curiously enough, the observation was again noted of another area of similar edema on the opposite side of the bladder. The stones again as in the case of the edematous area removed, were to be found while still small, only in the new area of edema.

TABLE 2

Composition of calculi of C. B., based on average results of analyses of 150 calculi

CALCULI	WEIGHT PER CENT
Lost on ignition	3.83
Total nitrogen (maximum 1.19; minimum 0.079)	0.12
Protein (maximum 1.18; minimum 0.49)	0.80
Sulphur	1.71
Urates	None
Fraction soluble in HCl	15.50
Aluminium	None
Iron (maximum 2.31, minimum 1.08)	1.67
Calcium	1.60
Magnesium	0.21
Sodium	5.27
Oxalic acid	0.45
Phosphorus pentoxide	0.63
Of fraction insoluble in HCl:	
Soluble in HF	93.2
Insoluble in HF	6.8
Silicon dioxide	72.60
Silicon	33.39

Histological examination of the removed edematous area proved it to be merely a proliferating cystitis.

All calculi obtained from the patient during the period from September 24, 1925, until April 20, 1926, have been tabulated with the weights and measurement in table 1. Thirty calculi were obtained. Of this number, three were passed by the patient and the remainder removed cystoscopically. The total weight of the dried stones was 4.29 grams. The color of the

calculi varied from gray to a light brown. A variation is also noted in the size of the stones. The larger were elliptical in shape and the smaller cuboidal. The diameters of the largest stone were 14 by 8 mm. and the dimensions of the smallest 1 by 1 by 1 mm. The weights ranged from 10 mgm. to 1.15 grams. An estimate of the rapidity of the formation of these calculi can be obtained from the observations on February 15 and 20. On February 15, a cystoscopic examination revealed no stones present in the bladder, but on February 20, 2 calculi were removed having a total weight of 0.25 gram.

In table 2 are reported the average results obtained in the analyses of 150 calculi. The stones lost on ignition 3.83 per cent of their weight. The pulverized material gave a positive reaction with Molisch's reagent. For total nitrogen an average figure of 0.12 per cent was obtained. This nitrogen could be accounted for only as protein, and the protein based on the nitrogen determination averaged 0.80 per cent. Considerable variation in the protein content of the stones is noted, the maximum figure being 1.18 per cent and the minimum 0.49. In larger stones, it was possible to demonstrate the protein in the central portion of the calculus. It appears that the nidus of the calculus was a protein, probably mucin. All specimens of urine examined showed the presence of mucin and were acid in reaction. However, no urates or uric acid were found in the calculi.

Of the total pulverized material, 15.5 per cent was soluble in hydrochloric acid. No aluminium was found in all of the stones analyzed. Attempts to precipitate aluminium as the hydroxide [$Al(OH)_3$] or as the phosphate ($AlPO_4$) were unsuccessful. Attack's colorimetric method for aluminium was also utilized. Attack claims for this method a sensitivity of 1 part of aluminium in 10,000,000 parts of water. This method also gave negative reactions for aluminium.

Iron was found in all stones analyzed. The iron was determined on mixed pulverized samples, and for the individual calculi, Wong's method was used. The average iron content was 1.67 per cent as iron, the maximum 2.31 and the minimum 1.08

per cent. In our studies on the composition of urinary calculi we find iron a frequent constituent.

Of 35 calculi obtained from other patients, we have found iron in 30, varying from a trace to 0.70 per cent. It is believed that the iron may be derived from the hematin of blood clots. This patient (C. B.) continuously voided in her urine small blood clots. The total sulphur was determined after fusion with KNO_3 and Na_2CO_3. The average of the sulphur determination was 1.71 per cent. No sulphates were found. The presence of this sulphur appears to offer further evidence of the existence of a mucin or mucoid as a nucleus of the calculi. Calcium and magnesium, oxalic acid and phosphoric acid were present in small amounts. Sodium was 5.27 per cent, but no potassium was found in the stones.

The portion of the stone, insoluble in HCl was fused with Na_2CO_3, and from the solution, silicic acid was precipitated by acidifying. The silicic acid was filtered off and dehydrated. The silicon dioxide again redissolved by fusion with Na_2CO_3 and precipitated and dehydrated a second time. Of this dehydrated fraction, 93.2 per cent was soluble in hydrofluoric acid. The silicon content as silicon averaged 33.39 per cent, or as silicon dioxide 72.6 per cent of the calculi.

Rosenbloom states that silicic acid calculi are rare. We have been able to find nowhere in the literature a report of silicon in urinary calculi in human subjects. However, silicon has been reported in the urinary calculi of plant eating animals. Liebner examined the urine stones of sheep and found that silicon dioxide formed 71.05 per cent of their weight. Pleischl and Bley have demonstrated silicon dioxide in human gall stones. Silicon is a normal constituent of the urine. Vierordt reports a normal individual excreting 0.45 gram of silicic acid during twenty-four hours, the silicon dioxide forming 0.03 per cent of the urine. Schultz observed 0.104 to 0.259 gram excreted in twenty-four hours on a mixed diet. The average amount of silicon dioxide excreted by our patient was 0.104 gram in twenty-four hours.

It is well known that silicon is an abundant element in the mineral and vegetable kingdoms, however, a review of the litera-

ture reveals that silicon is also diversely distributed throughout the animal body. The principal analytical reports of silicon in animal tissues are recorded in table 3. Silicon is a constant constituent of hair and nails, no less than 40 per cent of the ash of hair consisting of silicon dioxide. According to Schultz's

TABLE 3

Occurrence of silicon in animal kingdom

TISSUE	NUMBER OF ANALYSES	AVERAGE OF SiO_2 PER CENT OF ASH	OBSERVER
Beef	25	0.083	Schultz
Aorta	8	0.284	Schultz
Tendons (calf) and ox	36	0.486	Schultz
Sclera	19	0.237	Schultz
Vitreous humor	29	0.159	Schultz
Spleen capsule	34	0.455	Schultz
Spleen pulp	36	0.165	Schultz
Human muscle	63	0.053	Schultz
Human tendons	81	0.338	Schultz
Dura mater	28	0.336	Schultz
Fascia	29	0.246	Schultz
Ovarian cyst contents	65	0.031	Schultz
Human milk	1	Trace	Wildenstein
Cow's milk	1	0.075	Weber
Ox gall	1	0.36	Rose
Brain, human	1	0.42	Breed
Liver, human	1	0.272	Oidtmann
Pancreas, human		12.34	Kall and Kunkel
Human blood	1	0.53	Whitting
Beef blood		1.19	v. Gorup-Besanez
Chicken blood		0.96	v. Gorup-Besanez
Pus	1	0.046	Schultz
Wharton's jelly	For total solids	0.024	Schultz

extensive studies the connective tissue is especially rich in silicic acid, and the silicic acid content of the organs is almost directly dependent on their content of connective tissue. Moreover, the same tissues in the young are richer in silicon dioxide than those of older individuals. Hence the highest content of

silicon dioxide should appear in embryonic connective tissue. In this connection it is of interest to note that Wharton's jelly contains 0.024 per cent of its total solids as silicon dioxide. The silicon of animal tissue is no doubt derived from silicates in the vegetable portion of the diet, silicon playing an important part in communicating rigidity to many plant tissues. A considerable portion is undoubtedly consumed daily as dust, sand, and in natural waters. The insoluble portion of the silicon intake is lost in the feces unchanged. Some, however, is absorbed and finds its way into the blood and urine. Silicon dioxide forms a part of the ash of human, bovine and chicken blood. The largest tissue content of silicon dioxide is in the ash of the pancreas. Kall and Kunkel have stated that as iodine is stored in the thyroid so silicon is conserved in the pancreas, in which silicon dioxide may form 12.34 per cent of the ash.

The silicic acid content of the tissue seems to be dependent upon the supply in the diet. Gorup-Besanez conducted very intensive studies on the silicic acid content of feathers. He found in the feathers of grain eating birds 40 per cent of silicon dioxide in the ash, in meat, berry and insect eating birds, 27 per cent, and in fish eating birds only 10 per cent.

What part silicon plays in the life processes of the body is not known according to Schultz and Hoppe-Seyler. Only that portion of silicic acid which is soluble can be said to be of any significance.

Wöhler in 1863 directed attention to the analogy existing between carbon and silicon compounds. Silicon can displace carbon from its compounds. Schultz believes that silicon atoms can occur in place of carbon atoms in the proteins of connective tissue. Dreschel extracted with alcohol and ether a compound from feathers to which he assigned the formula $Si\ (O \cdot C_{34}H_{59}O)$ an ortho silicic acid ester of a bivalent alcohol, a homologue of cholesterol. We can no longer regard silicon as an inert element in the body's metabolism, and we believe in this case reported, we are dealing with an interesting anomaly of silicon metabolism.

CONCLUSIONS

While it is but natural to infer that because of the multiplicity of these stones, the presence of a large iron content, and more especially, an unusual if not unique amount of silica, that these stones were introduced from without, none of the gentlemen who have had the privilege of close study of all the manifestations presented by this unique case, and incidentally, they are qualified observers and by no means gullible, believe that these stones have had any but a metabolic origin. The reasons advanced are:

1. That this patient had complete remission of symptoms and stones for a period of six months following the removal of the edematous area.
2. That stones did not reappear until the formation of a new area of similar edema in another part of the bladder.
3. That the calculi while still small, were invariably found imbedded in the two areas of edema before mentioned and were only free on the floor of the bladder when they had achieved sufficient size.
4. That they were observed to increase in size while still in the bladder.
5. That the patient had an unusual iron and silica content in the catheterized urine, and that she had a considerable loss of the protective colloid substance found in normal urines.

DISCUSSION

Dr. Hermon C. Bumpus, Jr. (Rochester, Minn.): We occasionally see pyelograms quite similar to Dr. Boyd's and invariably the extra-cortical extravasation is pyramidal in form. Dr. Braasch, in discussing these findings at the time Dr. Lee-Brown reported his work on pyelo-venous back flow, stated that he always believed the media extended up the tubules and thus explained the pyramidal shape.

In the Journal of the American Medical Association, of March sixth, C. E. Bird and T. S. Moise report a repetition of Lee-Brown's work and have been unable to produce a pyelovenous back flow. They believe the reason Lee-Brown obtained the pyelovenous back flow was that a direct communication occurred between the pelvis and the venous system, probably the result of using kidneys too long dead. The work was very carefully done and checked and they believe the extra-cortical extravasation we see in the pyelograms is a reflux of the tubules.

Dr. Arthur H. Crosbie (Boston): It seems to me the condition that Dr. Boyd reports is due to overdistention of the kidney pelvis.

It is my custom in doing pyelograms never to inject more than 7 cc. at the first pyelogram. Even though you do have a large hydronephrosis, 7 cc. will show it up in good shape. Later on, if you want to check it up, you can inject more. But, in doing the first pyelogram, I never inject more than 7 cc.

Dr. Gilbert J. Thomas (Minneapolis): I have some slides to show. This may not be a good discussion of Dr. Frontz's paper, but I have just a few cases I would like to present.

(Slide) This shows a tumor of the pelvis of the kidney, somewhat similar to the one described by Dr. Frontz, with metastasis of the lower ureter. We were fortunate in finding the uretral

metastasis because the patient had blood in the ureteral specimen caused by a pelvic tumor which evidently made a large pelvic deformity, and ordinarily our examination would have stopped there. Fortunately, when the catheter was pulled out of the ureter, some of the tumor protruded from the meatus.

Dr. GEORGE R. LIVERMORE (Memphis): I have a slide I would like to show, which proves to us that depending upon pain is not worth anything, as far as the pyelographic media going out into the tissues is concerned, and to bear out Dr. Crosbie in his statement that we must not use too much.

(Slide) This patient only had 12 cc. of the media put into the pelvis of the kidney, and yet, as you see here, there is distinct extravasation of the media out into the tissues. Therefore, I am now using the manometer, in order to check up the pressure, in order to avoid just this accident.

Dr. WILLIAM A. FRONTZ (Baltimore): In reply to Dr. Thomas, I should think, from the pictures he has shown, that he was dealing not with an adenoma or a cyst-adenoma but rather with a papillary carcinoma of the pelvis or calyces.

Dr. MONTAGUE L. BOYD (Atlanta): I would not want the impression to get out that I am overextending the kidney pelvis. I am very careful to measure the pelvic capacity with normal salt solution and I find that a very accurate indication for the amount of pyelograph media that I can inject into a kidney. Thirteen cubic centimeters is a little more than I ordinarily inject. When I get a 15 cc. pelvic capacity, I inject 10. When I get 10 cc. with normal saline solution, I inject a smaller quantity. Perhaps in this case 13 cc. was too much solution, and extension beyond the calyces occurred on that account.

There is some question in my mind about the importance of the lesions which are produced by this extension. Certainly they are rare, but where a condition is produced, such as I have shown in this kidney, it must have some influence on the subsequent health of the kidney.

TRUE PROSTATIC CALCULI

CLINICAL DATA BASED ON SEVENTY-THREE CASES

HERMAN L. KRETSCHMER

Chicago, Illinois

Clinicians and authors are in accord that true prostatic calculi are rare, but this opinion is not based on the scientific data of today. In a previous paper on this subject a careful review of the literature was made and at that time only 165 cases were found. To this I was able to add 8 personal cases which brought the total number up to 173. Most of the articles and case reports from which the literature was drawn mentioned only single cases. Judd and Crenshaw, reported a series of 20 cases, this being the largest number of cases reported in any single paper that I have been able to find.

The present paper is based upon a series of 73 cases that are or have been under personal observation. It would appear, therefore, that prostatic calculi are not so rare an occurrence as we have been led to believe. There is no doubt that with the routine use of the roentgen ray in urological work, which obtains today, an increasing number of cases will be found.

INCIDENTS OF AGE

The youngest patient in this series was twenty-one years and the oldest seventy-six years. Between these two extremes the following ages occurred:

	Number of cases
20 to 30 years	2
30 to 40 years	11
40 to 50 years	17
50 to 60 years	24
60 to 70 years	12
Over 70 years	6
Not stated	1

The point of significance in this table is that the largest number of cases occurred in the fifth decade.

PREVIOUS ILLNESS

In order to determine whether or not there was an etiological relationship between previous venereal disease and the subsequent development of prostatic calculi, special care was taken, in obtaining the histories, to dwell upon this point. In this group of 73 cases, 32 gave a history of antecedant gonorrheal urethritis, 5 stating that they had had more than one attack, of which number 3 admitted having had a third, and one a fourth attack. Hence of the total number of cases the percentage of antecedant gonorrheal urethritis was only 43.835. In only 10 cases was a history of stricture obtained. In 5 cases a history of epididymitis was given. A positive history of syphilis was obtained in only 8 cases. In the remaining number of cases there was no history nor any evidence of venereal disease. It seems reasonable to assume, therefore, that venereal disease plays only a minor part as a causative factor in prostatic stones.

ONSET

The first symptoms or group of symptoms of which patients in this series complained were somewhat variable. This, in part, depends upon the presence of other coexisting pathology, that is, whether or not some other pathological lesion overshadows the prostatic calculi. For example, in several instances the immediate complaint was due to pain and colic caused by stone in the kidney or ureter, and the presence of prostatic stones was ascertained in the course of routine examination.

In a second group of cases the patients were free of all symptoms and all signs of urinary or sexual disease and presented themselves for urological examination prior to entering upon marriage. In another group the patients complained of lesions which are generally attributed to foci of infection, and to the end of ruling out the prostate and seminal vesicles as being etiological factors,

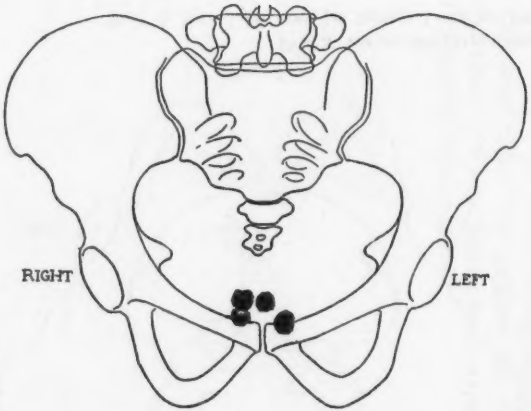


FIG. 1

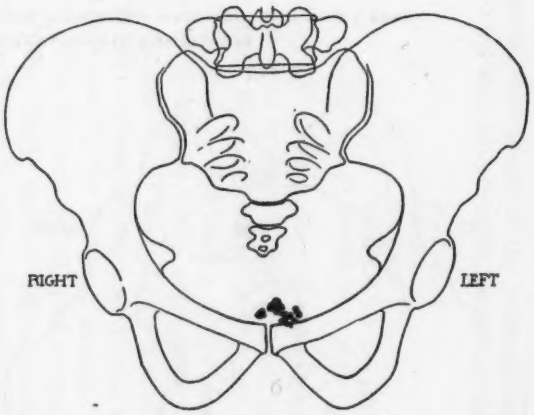


FIG. 2

FIG. 1. PRESENCE OF FOUR LARGE STONES
FIG. 2. MULTIPLE STONES, MOST OF WHICH ARE TO THE LEFT OF THE MEDIAN LINE

FIG. 3

FIG. 4

FIG. 3. SMALL MULTIPLE STONES ARRANGED IN TWO GROUPS

FIG. 4. SMALL STONES IN RIGHT LOBE OF PROSTATE ASSOCIATED WITH STONE IN THE URETER

it so happened that stones in the prostate were found. In this group were patients who complained of the following:

Lumbago
Sciatica
Neuritis
Arthritis
Rheumatism

Another group was characterized by the presence of referred pain or symptoms, such as pain in the perineum, pain in the sacrum, suprapubic pain, irritation at the neck of the bladder, pain and spasm in the rectum, a full feeling in the rectum, the most frequent referred symptoms being suprapubic and perineal pain. And in still another group the patients had had post-gonorrheal infections in the prostate and seminal vesicles for which they had been treated routinely by massage, sounds, irrigations, instillations, etc. The shortest duration of symptoms occurred in a case in which they began one day before the patient came under observation; the longest duration was twenty-eight years. In the latter the chief complaints were burning, hematuria, difficulty on urination and renal colic; this patient also had a very severe chronic prostatitis. Between these two extremes the following duration of symptoms was noted:

	Number of cases
1 day	1
6 days	1
10 days	2
25 days	1
1 week	3
2 weeks	2
3 weeks	2
4 weeks	3
5 weeks	1
2 months	1
5 months	2
6 months	4
9 months	1
10 months	1
15 months	2
1 year	6
1½ years	3

	Number of cases
2 years	5
2½ years	1
3 years	6
4 years	4
7 years	3
8 years	1
12 years	1
15 years	4
17 years	1
20 years	1
25 years	1
28 years	1
Not stated	6
All his life	1
Since childhood	1

URINARY SYMPTOMS

The group symptoms mentioned most frequently were urinary in character. Urinary symptoms may at times be due as much to the presence of coexisting lesions as to the calculi. Indeed, it may be quite difficult at times to state just what part of the symptoms is due to the calculi, and what part to the chronic prostatitis which is so frequently found to be an associated finding. Moreover, these symptoms, considered either singly or in combination, are never pathognomonic, hence a diagnosis based on urinary symptoms alone can rarely if ever be made. Indeed, urinary symptoms were absent in 9 cases, the result being that these patients considered themselves perfectly normal and only presented themselves for examination because they intended to marry.

Of the urinary symptoms, frequency of urination easily heads the list, having been present in 46 of the 73 cases, or 63.01 per cent. Nocturia was present in 36 cases, or 49.31 per cent, being a very close second. Burning on urination was present in 26 cases, and this sensation generally occurred during and sometimes after urination and was located in the urethra and around the neck of the bladder. The following table summarizes the urinary symptoms:

	Number of cases
Frequency	46
Nocturia	36
Burning	26
Hematuria	18
Dribbling	17
Pyuria	16
Urgency	15
Difficulty	15
Painful urination	11
Retention	6

SEXUAL SYMPTOMS

The sexual symptoms were much less common and occupy a position subsidiary to the urinary group. The most frequently noted symptom was lack of sexual desire, which was present in patients whose ages varied from thirty to fifty-four years. Imperfect erections were noted with considerable frequency, and complete impotence occurred in four patients who were forty-two, forty-five, fifty-three and fifty-four years of age, respectively. Most of the patients, however, were under forty-five, hence the conclusion must be drawn that the calculi rather than age had something to do with this symptom.

HEMOSPERMIA

Hemospermia was noted in only 3 cases, due no doubt to a coexisting infection in the seminal vesicles. While sexual symptoms are of frequent occurrence, they do not dominate the clinical picture nor is there anything about them that is pathognomonic.

URINARY FINDINGS

Careful urinary analysis revealed the presence of some abnormal urinary constituents. In 66 of the 73 cases, in other words, practically in every case urinalysis indicated the presence of a pathological element. Pus was the one element most frequently found, being present in 62 cases, or 84.93 per cent. Albumen was found in 26 cases, blood in 25 cases, and sugar in only 2 cases.

FIG. 6. MULTIPLE STONES IN LEFT LOBE

FIG. 5. MULTIPLE STONES LOCALIZED IN RIGHT LOBE

FIG. 8. SOLITARY STONE IN RIGHT LOBE

FIG. 7. SHADOWS IN BOTH RIGHT AND LEFT LOBES

Cultures were not made, as a routine, in the early cases, hence certain records were devoid of reports of urinary cultures. However, in the cases in which cultures of the urine were made, the cultures of colon bacillus head the list, the staphylococci being second, and in a few instances both colon bacilli and staphylococci were found together. Streptococci were entirely absent. Today cultures of the urine are a part of the routine in every clinic, therefore it can be stated in all truth that the future will yield us very accurate data on this most interesting point.

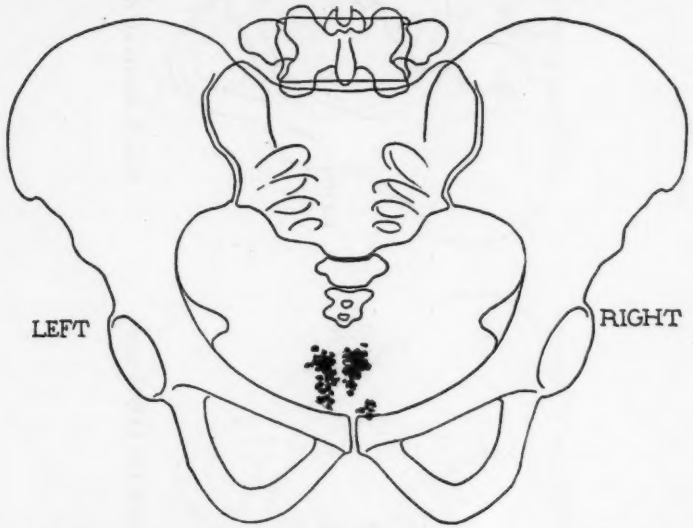


FIG. 9. TWO LARGE MASSES OF STONES ASSOCIATED WITH A SMALL GROUP OF STONES JUST ABOVE THE PUBIC BONES

RECTAL FINDINGS

Careful examination of the prostate per rectum showed suspicious changes in the largest number of instances. In cases in which the calculi were small and were associated with benign hypertrophy of the prostate, the rectal findings were those of benign hypertrophy. However, in the average case the most

striking finding was a change in the consistency of the prostate which, at times, was found to be of extreme hardness so that the condition simulated carcinoma. In several of these cases it was impossible to differentiate between stone and carcinoma except by means of the roentgen ray. On account of the possibility of confusing these two conditions, we have instituted a rule to x-ray every case of carcinoma or suspect carcinoma. In this series, in several of the cases in which large stones were present,

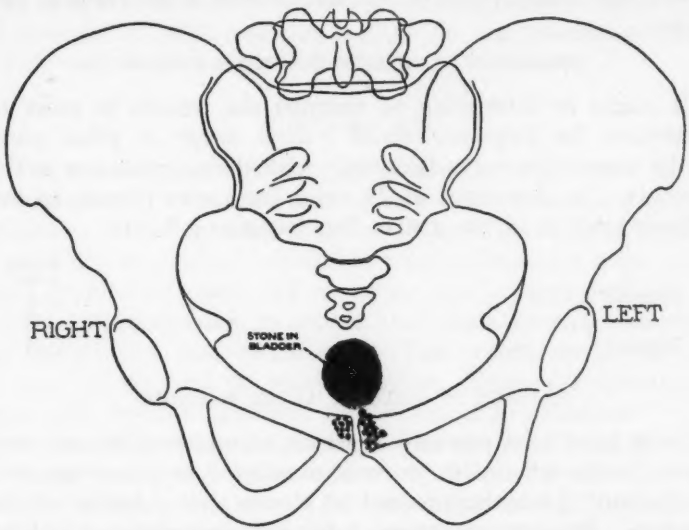


FIG. 10. LARGE STONE IN BLADDER ASSOCIATED WITH MULTIPLE STONES IN THE PROSTATE, THE LARGER COLLECTION OF STONES BEING IN THE LEFT LOBE
They are seen behind the symphysis

great irregularity of the surface was produced, not unlike that seen in carcinoma of the prostate. In some cases palpation of the stone per rectum was possible, the result being that a diagnosis could be made before roentgenograms were taken. The older clinicians and authors placed considerable emphasis upon crepitation upon rectal examination declaring this a symptom so frequent of occurrence that it was pathognomonic. Crepitation was not often present in this series.

Besides the changes in consistency and contour, the prostate was frequently enlarged in a definite manner so that no doubt exists of this point. In a small group of cases the prostate was not enlarged, the gland being normal in size or even smaller than normal. This type of prostate is practically always harder than in the normal state, but the normal size in combination with the extreme hardness is striking. When this condition was found a tentative diagnosis of stone was made and then x-rays were taken. A soft and boggy prostate occurred in only a few cases in this series.

PRESENCE OF STONES IN OTHER ORGANS

It might be interesting to examine the records in order to determine the frequency which calculi occur in other parts of the urinary tract synchronously with their appearance in the prostate. In this series of 73 cases they were present in the urinary tract in 18, the distribution being as follows:

	Number of cases
Kidney	6
Ureter	6
Bladder	6

PASSAGE OF CALCULI AFTER MASSAGE

Cases have been reported in which a number of stones were passed in the urine after prostatic massage. In a case reported by Hubeny the patient passed 54 stones after massage of the prostate. Passage of stones following massage was not of common occurrence in this series of cases, in spite of the fact that some of the patients had been treated by prostatic massage for a long period of time. Removal of the stone by means of the urethroscope is also on record.

STRIPPINGS FROM THE PROSTATE

Strippings obtained by means of prostatic massage were examined to ascertain the presence of pus as well as bacteria. Unfortunately in some of the earlier cases in this series the records fail to give the desired information.

	Number of cases
Pus present	32
Normal fluid	8
Not stated and not done	33

It is evident, therefore, that calculi may be present in the prostate without the presence of pus in the strippings. On the other hand, in cases evidencing pus in the strippings with a history of long-continued treatment from which the desired relief is not obtained, it is necessary to have roentgenograms made in order to exclude, in case the picture is negative, the presence of stone which might be a factor causing failure of treatment.

ROENTGEN RAY

The one diagnostic aid that gives us most information is the roentgen ray. Its routine employment often shows the presence of stones when least suspected. It is my opinion that in case a good film is obtained, which has been made with special reference to prostatic area and no stones can be demonstrated, it would seem reasonable to assume that stone, as a factor in the patient's illness, can be excluded. The routine use of the roentgen ray has led to many surprises: stones are recognized which but for this diagnostic method would go unheeded.

Reasonable care should be exercised in taking the films, thought being given to project the shadows of the stones when present above the pubis. In several instances in our series, the shadows were only recognized after very careful plate reading, because the shadows were seen behind the shadow of the symphysis pubis. This required the taking of another film projected in such a way that the stone shadows were projected above the symphysis. As a rule, the shadows lay on either side of midline, although occasionally they were seen either on the right or left side; hence, shadows may be seen only on one side or they may be located at midline. As a rule the shadows were very small, but instances were encountered in which very large stones were seen. Some difficulty in interpretation may arise in cases in

which films show the presence of multiple shadows in the bony pelvis. These shadows, as we all know, are due to lesions outside the urinary tract.

DIFFERENTIAL DIAGNOSIS

The three lesions which most frequently cause confusion in the differential diagnosis are carcinoma, tuberculosis and chronic prostatitis. As previously mentioned, authorities have stated that carcinoma and stone do not occur in the same patient. Nevertheless, in this series carcinoma and stones were associated in five cases. Some difficulty may arise in differentiating stone from carcinoma and, in several cases, in this series, it was impossible to achieve this end by means of a rectal examination alone. In these instances, differentiation by means of the roentgen ray has always proved successful.

In several instances occasion arose in which we were obliged to differentiate between prostatic calculi and calcification due to tuberculosis. As a rule, in these instances, other evidences of tuberculosis were manifest, such as tuberculosis of the epididymis, seminal vesicles, bladder, or kidney. In these cases it was assumed that the calcification was due to tuberculosis rather than to simple stone.

In certain cases of chronic prostatitis, when the desired relief is not obtained and rectal examination fails to clear up this point, our rule is to examine such cases routinely with roentgen rays to ascertain whether or not stones are present. Furthermore, all cases of chronic prostatitis that give a history of having been under treatment for a long time and still have evidence of pus in the prostate and symptoms referable to that gland, are subjected, for similar reasons, to x-ray examination.

ASSOCIATED LESIONS

In some of the cases in this series, stones were found during routine physical examination, although no symptoms presented themselves which could be attributed to their presence. In another group of cases, there was evidence of disease in other organs, the importance of which, at times, outdistanced any

symptoms due to the presence of stones, and, furthermore, no connection between the two was apparent.

A review of the histories showed the following lesions:

Lesions of the prostate

	Number of cases
Stones without other lesions	19
Recurrent stones in the prostate	1
Chronic prostatitis	12
Carcinoma of the prostate	5
Hypertrophy of the prostate	7
Hypertrophy and kidney stone	2
Abscess of the prostate and kidney stone	1
Median bar	1
Median bar and diverticulum	1
Stone in seminal vesicle	1

Lesions of the kidney

Chronic nephritis	2
Stone	2
Kidney, bladder and ureter stone	1
Hydronephrosis	1
Pyonephrosis	1

Lesions of the bladder

Carcinoma	1
Papilloma	1
Stone	1

Lesions of the urethra

Stone	3
Stricture	6
Periurethral abscess	1

Miscellaneous lesions

Arthritis	2
Spinal syphilis	1

SUMMARY

1. Stones in the prostate occur more frequently than is generally believed.

2. They may be present without causing any characteristic symptoms.

3. Not infrequently they are associated with other lesions of the urinary tract, the symptoms of which overshadow those of prostatic calculi.

4. The fact that they are liable to occur in chronic prostatitis may account for the pus in the strippings and for the failure of routine treatment.

5. They are often associated with more serious diseases such as benign hypertrophy and carcinoma.

REFERENCES

HUBENY, M. L.: Amer. Jour. Roentgenol., 1919, vi, no. 6, 286–289.
JUDD AND CRENSHAW: Minnesota Med., 1919, ii, 52–56.
KRETSCHMER, H. L.: Surg., Gynecol. and Obstet., 1918, xxvi, 70–76.

GONORRHEAL ABSCESS OF THE WRIST

THOMAS F. LAURIE

Syracuse, New York

The following case is of sufficient rarity to warrant its being reported:

Woman, aged thirty-two, married was admitted to the Syracuse University Hospital November 27, 1925. Her chief complaint on admission was pain and swelling in the region of the right wrist and vaginal discharge. The pain in the wrist had been present for about two weeks but the swelling had become more noticeable the night before entrance to the hospital. Three weeks before entering, patient began to have a vaginal discharge and was taken with pain in the region of the umbilicus which radiated to each groin. This was severe and paroxysmal in character, and accompanied with nausea and vomiting. A physician was consulted and relief obtained for this but the vaginal discharge continued and in another week the pain began in the wrist, was continuous but not severe enough to incapacitate her for her housework.

The previous and family history are unimportant and neither have any bearing on her present trouble.

Temperature on admission was 98.4°, pulse 100, respirations 20, tongue slightly coated. Examination of the heart and lungs negative, the abdomen was tender in the mid-line below the umbilicus but no rigidity was noted. Vaginal examination revealed no rectocele or cystocele, cervix pointing anteriorly, size and position of uterus normal and freely movable. There was a bilateral laceration of the cervix with considerable swelling and redness, and a muco-purulent discharge. There was also a slight vaginitis. There was marked tenderness directly over the uterus when pressure was exerted on the cervix. No masses were felt. Examination of the vaginal discharge revealed many gonococci. There was a swelling on the dorsum of the right wrist extending from about 2 inches above the wrist joint toe the metatatso-phalangeal joints, covering the whole back of the hand. Directly over the lower end of the radius also on the dorsum was a reddened, fluctuating area about 1 inch in diameter elevated above the swelling already de-

scribed. The movements of the wrist joint were not painful but restricted somewhat on account of the swelling. Movements of the fingers were restricted also but not particularly painful. Roentgenogram failed to show any bone abnormalities. Blood count was normal and blood culture showed no growth.

The vaginal gonorrhea was treated with hot douches and the abscess on the wrist incised with the evacuation of a small amount of pus which contained gonococci both on smear and culture. During the early part of her stay in the hospital she received three doses of gonorrheal mixed vaccine. Patient left the hospital on December 13, 1925, about three weeks from the time of admission with the wound healed.

DISCUSSION

It has been known for some time that gonorrhea frequently becomes systemic. We have ample evidence of that. It must be remembered, however, that the usual habitat of the gonococcus is on mucous or serous membranes. There was no evidence in this case that this abscess had any connection with the joint or tendon sheath. A search of the literature fails to show reports of many such cases. One case reported by Ware (1) had an apparent myositis of the deltoid muscle which when incised revealed a serous fluid containing gonococci. Cases reported by Dwyer (2), Harris and Haskell (3), Dufour (4), Mira (5), Klippel and Rachet (6), Kirmse (7), all were similar to this one, some having single and some multiple metastatic abscesses and none in any way connected with either serous or mucous membranes. The total number of cases reported by these writers is eight. Luton (8), reports a case of perinephritic abscess occurring as a complication of gonorrheal urethritis in a male but no evidence was presented that the abscess cavity contained gonococci.

REFERENCES

(1) Ware: New York Med. Jour., January 13, 1906, lxxxiii, 87.
(2) Dwyer: Jour. Amer. Med. Assoc., December 11, 1920, lxxv, 1643.
(3) Harris and Haskell: Bull. Johns Hopkins Hosp., December 1904, xv, 395.
(4) Dufour: Societe Medicale des Hopitaux, 1924, xlviii, 633.
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Again, in the course of routine x-ray examinations shadows are frequently found in the prostatic area which may look for all the world like prostatic calculi. Nevertheless, the patient may have no urinary symptoms and on physical and cystoscopic examination there may be no evidence of prostatic stone.

On urethroscopic examination evidence of calculi is often found in the prostatic urethra. Occasionally an edge of the prostatic calculus may be seen protruding from a prostatic duct. Frequently minute areas of dark pigment are observed in the prostatic urethra which are highly suggestive of the presence of these calculi.

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This problem has arisen on several occasions. Shadows suggestive of prostatic calculi may be present. On rectal examination the prostate may be slightly enlarged and nodular. Cystoscopic examination may show a definite median bar which would account for the patient's urinary symptoms. The question arises whether we are justified in doing a punch operation in the presence of evident prostatic calculi.

I would like to ask Dr. Kretschmer what percentage of the cases reported were operated on.

Dr. EDWARD L. KEYES (New York): I would like to add two points to what has already been remarked about on the matter of prostatic calculi. One is the report of an observation made upon a patient suffering from hemospermia. He had a prostate that felt normal, but from which I was able to squeeze out a great number of small, round bodies that resembled fish eggs. They were almost translucent, and very numerous, and quite hard. Under the microscope, they appeared to be made of organic matter with substance adherent to them which looked like amorphous phosphates.

Chemical analysis of these was attempted, but unfortunately the specimen was lost. On two occasions, I squeezed these out, and subsequently I was unable to get any out. It is possible that there were the beginnings of prostatic calculi.

Another fact I wish to insist upon is one mentioned by Dr. Kretschmer, but I feel not quite emphasized as I would emphasize it, as I have emphasized it, indeed, in the past. That is the grave possibility of making a diagnosis of carcinoma of the prostate on a patient with large prostatic calculi. I have seen very sad mistakes of that sort made, the patient being told he was going to die of cancer—the sadness in this case referring largely to the gentleman who made that statement. (Laughter.)

Dr. GEORGE R. LIVERMORE (Memphis): I would like to bear Dr. Kretschmer out in the fact that calculi do occur in the carcinomatous glands. I have had one case of that type in which multiple small calculi were found throughout the gland.

Another feature I would like to mention is the frequency with which prostatic calculi occur. It must be far more in proportion than the one hundred and forty-eight, I believe, which he said had been reported in the literature. I, personally, have seen at least six cases of this type. In one of them, a case of impassable stricture of the urethra; the case was operated, and no stone at that time was found or felt; later an x-ray of the bladder showed several stones apparently in the bladder but when operated the stones were found to be in the prostate gland.

Dr. JAMES A. GARDNER (Buffalo): I would like to have Dr. Kretschmer more specifically tell us how his x-ray man takes these pictures. We have all found that prostatic stones are overlooked frequently, although x-ray examination was made.

Dr. JOSEPH HUME (New Orleans): I have seen, of course, a fair number of prostatic calculi, and I agree with Dr. Braasch that the diagnosis is by no means easy, the x-ray being fallacious, also the finger. The most interesting things I have seen have been people who have passed numbers of small calculi the size of small grains of rice, or about as big as a No. 8 shot.

In cystoscoping one of these cases that had passed eight or ten of these small calculi, a man of seventy, with hypertrophy of the prostate, I was fortunate to see, as you sometimes do, one of these small stones projecting out of an apparently dilated prostatic duct. I could not get it out in any other way, except by using high frequency, and over a period of several months we got some three hundred-odd stones, which were counted, besides a good many that were lost.

As we used the high frequency current, we would cut through a thin layer of tissue and expose a cavity that would have six, eight, or ten small stones in it. We would wash or the patient would pass these out. There would be an interval of several days or weeks without any phenomena, then a stone would crop up. On re-cystoscoping, we would find another cavity a little deeper and covered with a thin layer of tissue. On incising this with the high frequency current, we would find another nest of stones.

In that way, we got rid of some three hundred stones without laying up the patient or getting any secondary phenomena.

Since then, I have had the good fortune to remove hypertrophied prostates which, on section, showed the same cave-like formations, each one containing a number of stones. I have had one more case in which with the high frequency current I was able to carry out without any accidents the same process and get a well patient without any trouble.

Dr. JOSEPH F. MCCARTHY (New York): In reporting this case before the New York Academy of Medicine, the very natural suggestion was made that these stones had been introduced from without, and that they did not occur in the metabolism of the patient. I then asked, "How about the fact that she failed to have recurrence of the stone for six months following my operation?" This was rather facetiously answered by, "Maybe she did not like your operation." (Laughter.)

The fact is that when small, we found these stones were always embedded in the localized area of papillary edema.

Another point of importance here is the fact that these stones following operation did not recur until a new area of papillary edema appeared in another part of the bladder. These stones were not observed upon the floor of the bladder until they had assumed considerably larger dimensions.

The varying size of the stones, as you have seen in the specimen passed around, would indicate in some measure, I think, the physical impossibility of implanting these stones in the bladder and carefully placing them in the edematous area. The large silica content in her urine as well as the absence of aluminum in the stones removed and the widespread appearance of this element in the common or garden variety of stones is very significant. Dr. Killian will call attention in greater detail to the importance of this observation.

Dr. JOHN A. KILLIAN (New York): When in the analysis of these stones I first found silicon, I was very reluctant to report the findings, believing, of course, that the stones had been intro-

duced extraneously. But all of the stones that we have examined, one hundred and fifty of them, have shown the presence of this silicon and all of them have shown an absence of aluminum.

Silicon is, next to oxygen, the most abundant element in nature, and next to silicon comes aluminum. In the minerals that we find distributed on the surface of the earth, silicon is combined with aluminum, either with iron in addition to that, or with magnesium, or calcium and magnesium. In nature, silicon is also found in combination with alkaline elements as silicates, but these silicates are soluble in alkaline waters, so that in the action of the alkaline waters on the minerals distributed on the surface of the earth, the soluble silicates are removed.

So it is impossible to pick up anywhere a pebble which on analysis will not show the presence of aluminum. Hence I think the absence of aluminum from the stones in these cases is very good chemical evidence that they were not introduced extraneously into the bladder.

The next question that arises is: Where does the silicon come from?

All workers are agreed that silicon is introduced into the body in the food, and it very probably is introduced in largest quantities in the vegetable material. We placed this patient for a time on a vegetable-free diet, but during that period the stones appeared in the bladder, and were removed just as rapidly as on a mixed diet; and when she was placed on a vegetable-rich diet, the stones appeared to be formed as rapidly as on the mixed diet.

The findings I gathered from the literature on the distribution of silicon in the animal kingdom brought out the fact that it is found just as abundantly in the animal kingdom as in the vegetable kingdom. So restriction of the vegetable diet will not prevent the formation of the silicon stones.

All the specimens of urine that we have examined from this patient have shown the presence of silicon, and she has been excreting on the average of about forty-five milligrams of silicon dioxide in twenty-four hours, and all specimens of urine have given an acid reaction. Silicon dioxide is soluble in alkalies but it is insoluble in acids.

Among the etiological factors that have been proposed as the cause of the production of stones, I believe the most promising is that of the absence, or the decreased concentration of a protective colloid in the urine. By examination of the urine from this patient for the protective colloid, using Kottman's reaction (which was first proposed for the colloid in blood serum), we have been able to show that the protective colloid is absent from the urine voided from the bladder.

The urine voided from the bladder also had a peculiar gelatinous appearance, which was not due to mucus.

The one practical point I would like to make is with regard to the necessity for a complete chemical examination of calculi, if the chemical examination is to be of any practical value. As an illustration, some of these calculi were examined in the hospital in New York City when first removed, by a man of considerable reputation; his report was that the stones were composed of urates, and that opinion was based upon the few qualitative tests which he carried out in examining the calculi, namely: that the calculi charred on heating, demonstrating the presence or organic matter; secondly, that on attempt to dissolve them in hydrochloric acid, a large portion of the calculus was insoluble (urates and uric acid are insoluble in acids); thirdly, that on examination of the pulverized material microscopically, it showed yellowish brown crystals.

All of those findings were correct, but the analysis of the stone completely, until we had accounted for the total weight of the calculus, showed continuously an absence of urates or of uric acid.

One other possibility arose in the analysis and that was that the proportion of the stone might be due to cystin. Cystin, of course, is a sulphur compound, and in our findings for sulphur we found sulphur present in only small quantities, and that could be accounted for by the protein that was present.

Dr. Herman L. Kretschmer (Chicago): There are several points in the paper that I omitted and skipped through in order to expedite matters.

Answering Dr. Braasch, I wish to say that I agree with him that

crepitus, as determined by rectal touch, was exceedingly rare. It is one of the symptoms mentioned by the old writers, but we have found it to be extremely uncommon.

Dr. Braasch said something about operating upon these patients. It is extremely difficult sometimes to decide whether you shall advise these patients to be operated upon or not, particularly when the stones are small and are not producing very much in the way of symptoms. Where the stones are large, we have made it a rule to operate upon them through the perineum, doing a perineal prostatotomy, and packing the cavity with gauze, because, as is well known, these stones tend to recur, just as they do in other parts of the body.

Dr. Braasch has seen them come out of the prostate with the urethroscope. We have massaged stones out of the prostate, and Dr. Hubeny, in Chicago, reported a very interesting case some years ago in which he took a picture before massage was instituted and after, which showed the shadows gone after massage, and the massage netted a total of fifty-four stones.

The point brought out by Dr. Keyes with regard to carcinoma is a very important one, and if we do not make this differentiation, we will get into trouble.

Dr. Gardner wanted to know about how these pictures are taken. Dr. Hollis E. Potter, who takes most of them for us, says that he opens up the pelvis; he shoots the rays down at a certain angle. I can not give you his technique, but I am sure your x-ray men can figure it out. After we did this, we found more stones than we did before. I think that they are overlooked because the x-ray man takes a picture antero-posteriorly, and a lot of these stones are hidden behind the symphysis.

Dr. NATHANIEL G. ALCOCK (Iowa City): I wish to discuss Dr. McCarthy's paper because I have had two of those cases, and they are puzzles to me. One case was purely a fake. There was nothing wrong urologically.

This patient went to Rochester and sprang one of her attacks and the next morning presented one of the men with one of these calculi, which they analyzed and reported to me (but did not tell

her anything about it) as silicon. When I informed her of this, she was very angry with me. That was a pure fake, as proved later.

Another case that I have had, I am not so sure about. I presented her at the meeting of the North Central Section of the American Urological Society two years ago. She had numerous attacks of colic on the left side, with a normal pelvis, and normal ureter. I took out twenty-eight calculi from her bladder within a period of five or six months, and an analysis of the stones showed 80 per cent of silicon. That was done by Dr. Myers. I could not conceive of those calculi coming down from that kidney because the ureter and pelvis were normal. We had never been able to catch one with the x-ray above the bladder.

Three stones were getting larger and larger each time we took them out—the largest one being about as large as a hickory nut, and none of them being smaller than a pea. I accused her of putting them into the bladder. She became very indignant and went to somebody else and she has had since something like twenty other stones taken out. I also understand that in one of her attacks, they x-rayed her and found a shadow in the region of the left ureter.

DEMONSTRATION OF IMPROVED INSTRUMENTS

JOSEPH F. McCARTHY

New York City

This is a little appliance (fig. 1) for injecting novocain into the deeper tissues of the urethra, vesical neck and base of the bladder (fig. 2) in the presence of infiltrating growths, or for operative procedures. On this end is an opening for syringe adjustment. There is another attachment here for connection with a diathermy machine, so that with these interchangeable attachments, one can apply this electrode for diathermy or infiltrate without the complete removal of the appliance (fig. 3). The apparatus just described was devised by Dr. Joseph A. Hyams, of our urological department.

This is an ejaculatory duct catheter carrier. It is composed of two metal tubes encased in a single sheath of metal (fig. 4).

At the termination of the encasement the tubes diverge. They bend downward and converge so as to meet the ejaculatory duct orifice at an angle of approximately 45 degrees to the urethral floor. This places the ejaculatory duct catheter in line with the course of the first portion of the ejaculatory duct and facilitates catheterization of the duct.

Here is another attachment adjustable to the foroblique panendoscope (fig. 5). Its advantages are that one can focus it to the individual eye, and can rotate it to such an extreme point away from the center of the lumen that it permits of an unusually wide field of operative manipulation and still maintains an usually brilliant visual field (showing slides). We wish also to illustrate here a system of water suction drainage suitable for ward beds (fig. 6). It consists of a series of pipes attached to the water system with Sprengle pumps interposed so that water rushing through two cones in approximation with each other at their apices generates considerable suction in a right angle tube

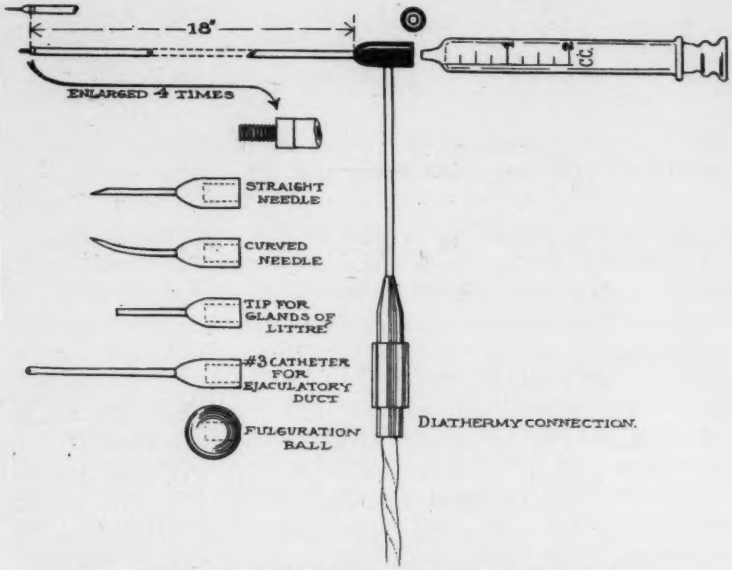

FIG. 1. HYPO-DIATHERMIC ELECTRODE SHOWN IN UPPER PORTION OF ILLUSTRATION

A straight curved needle for injection of mucosa; blunt-tipped needle for treatment of glands of Littre; tip for injection of the ejaculatory duct; ball electrode.

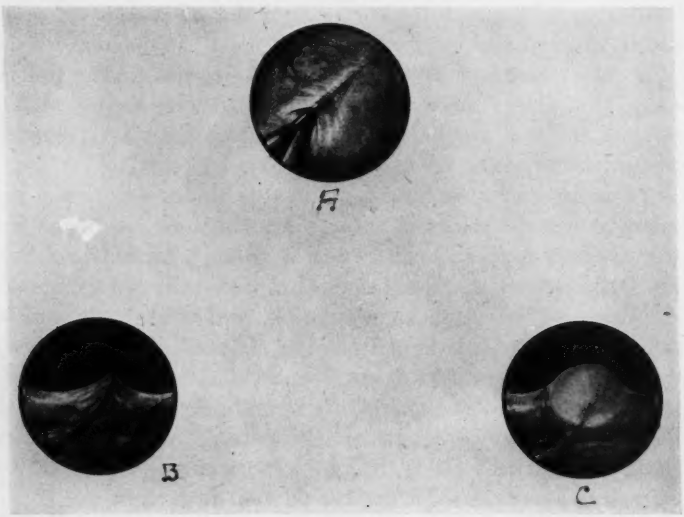

FIG. 2

A, gland of Littre with needle in position; *B*, sphincter of bladder with needle in place; *C*, sphincter of bladder with solution injected.

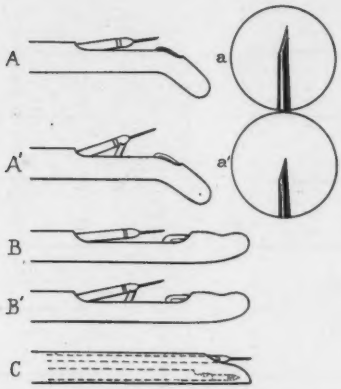

FIG. 3. SHOWING THE HYPO-DIATHERMIC ELECTRODE IN (*A'*) BROWN-BUERGER CYSTOSCOPE, (*B'*) MCCARTHY CYSTO-URETHROSCOPE, (*C*) MCCARTHY PAN-ENDOSCOPE

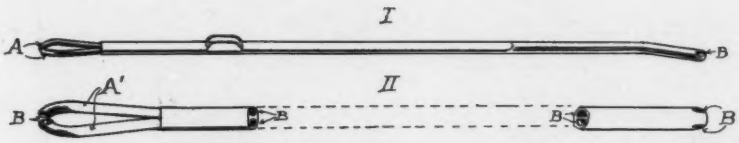

FIG. 4. EJACULATORY DUCT CARRIER

1, tangent view: Terminal end of carrier with curve directing catheter to ejaculatory duct orifice. *2*, view from below showing orifices of ejaculatory duct carriers.

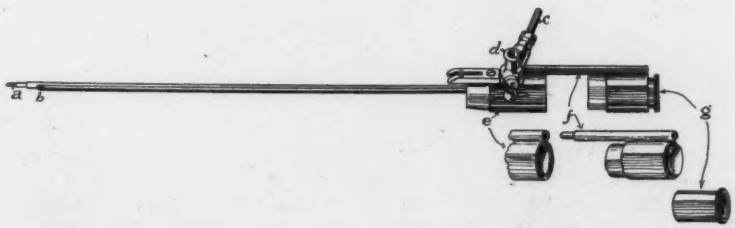

FIG. 5. TELESCOPIC AND SUCTION ATTACHMENT FOR PAN-ENDOSCOPE

a, electric light; *b*, suction tube; *c*, electrical connection; *d*, pet cork for suction; *e*, connection piece for Pan-endoscope; *f*, telescopic connection; *g*, telescopic lens.

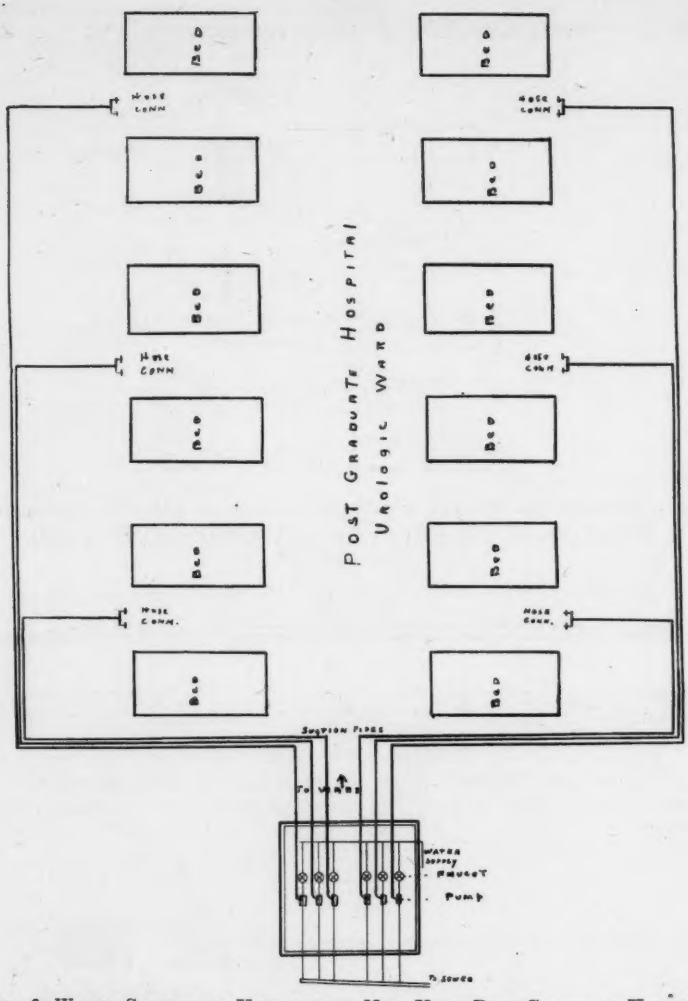

FIG. 6. WATER SUCTION AS USED AT THE NEW YORK POST-GRADUATE HOSPITAL UROLOGIC WARD

A, a series of water suction pumps in the wash room adjoining the Urologic Ward; *B*, water supply to six pumps; *C*, screw cock for shutting off water for individual pumps when not in use; *D*, small water pumps in position; *E*, waste pipe; *F*, suction tubes entering the ward (three to each side of the ward, so arranged as to be able to supply each of the twelve beds with suction); *G*, two outlets for suction to which rubber tubing may be attached so the suction can be carried to each bed. Small pet cocks present so as to shut off suction if not used.

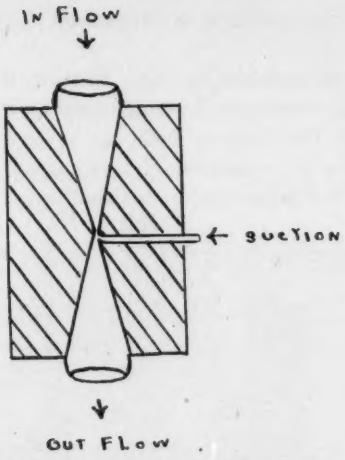

FIG. 7. INDIVIDUAL PUMP MADE OF BRASS TUBING WITH HOURGLASS LUMEN

Just below the constriction a transverse bore is made: this is the point at which the suction is produced and from which suction is carried to the patient as described in text.

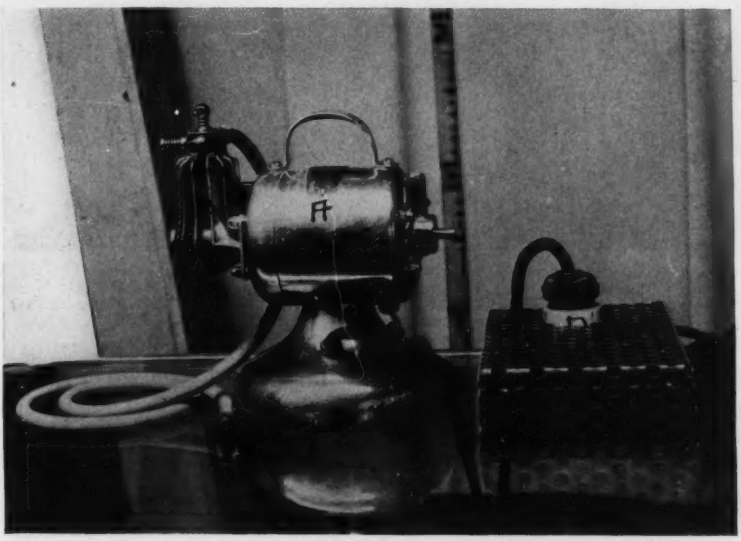

FIG. 8

A, motor; *B*, cylinder; *C*, suction tube; *D*, electrical interrupter

adjustable to these apices (fig. 7). Suction is then carried out into the general wards and attachments or connections are arranged between the various beds, so as to supply suction for each patient. We have employed this system for the past five or six months with a great deal of satisfaction.

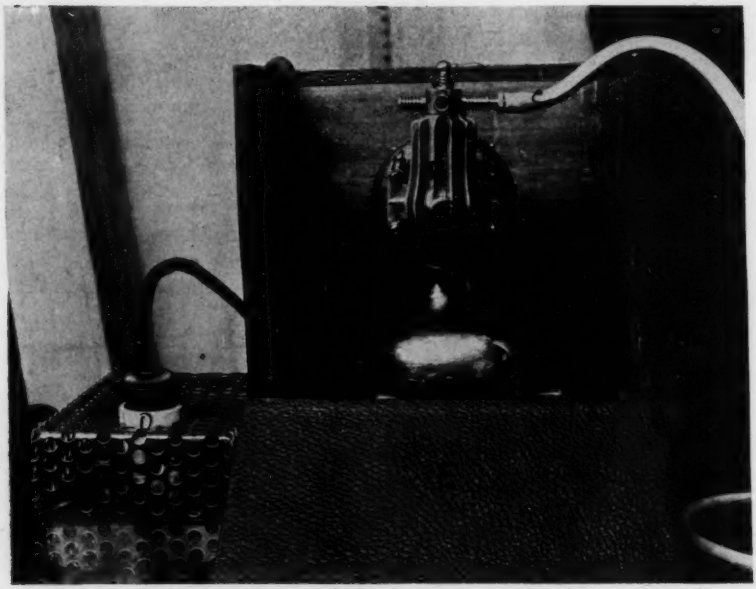

FIG. 9

A, Motor; *B*, cylinder; *C*, suction tube; *D*, electrical interrupter; *E*, leather box container.

This is an electric pump which is an improvement over other similar pumps used for suction for several reasons; first, we found that the earlier models would overheat, therefore we introduced an automatic interrupter, causing the pump to stop fifteen seconds and run for seven and one-half seconds. Secondly, there is a resistance coil in this apparatus (showing) remote from the motor so that the latter does not overheat (fig. 8). The resistance coil may be placed outside of the room with an electrical connection leading to the pump.

Another factor was noise. It is possible to reduce noise in this motor by putting the instrument in a box so that it is practically

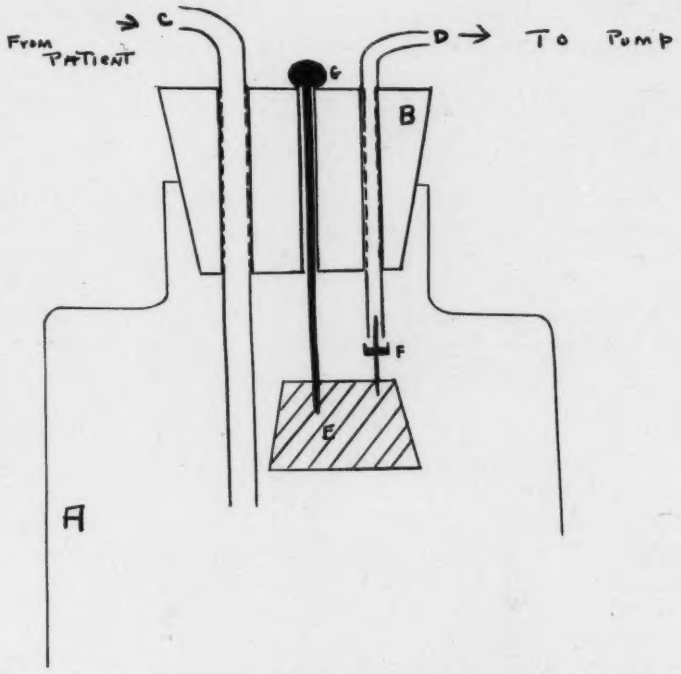

FIG. 10. SUCTION BOTTLE WITH CORK DEVISED TO PREVENT WATER OR URINE FROM BEING DRAWN INTO PUMP

A, 2-quart bottle. *B*, rubber cork with 3 perforators for: *C*, metal tube which carries urine from patient to bottle; *D*, metal tube leading from pump to bottle for suction; *G*, plunger and cap for safety. *E*, cork with plunger attached (this cork is floated when bottle contents reaches it, raising plunger and cup, thereby breaking suction and allowing escape of fluid should bottle be filled before it comes to the attention of the attendant). *F*, small cup fitting over end of *D* protecting pump from fluid.

noiseless (fig. 9). Ordinarily, we place it at some distance from the patient.

The matter of lubrication has been solved inasmuch as this

pump can run continuously for one month without additional lubrication.

The problem of overflow of the reservoir with its attendant damage to the motor is automatically controlled by a cork float which rises with the fluid content and at a certain point closes the suction tube leading to the motor (fig. 10). No water can thus enter the pump even though it continues to work in the presence of a full reservoir. The question of overflow is also provided for automatically.

This pump could not have been brought to the present state of perfection without the able collaboration of Dr. J. Sydney Ritter.

DISCUSSION

Dr. JOSEPH F. MCCARTHY (New York): I might begin by asking the coöperation of the members of the Society in the further study of these calculus cases. Most of us throw them aside. Our work would be facilitated if we had your coöperation. If you will send us these stones with a brief history, we will be glad to send you back a minute report, with Dr. Killian's suggestions on their metabolic management.

The first apparatus I wish to show is a system of suction or drainage applicable to a general ward. This system has worked out so well in our department (Dr. Morton saw it the other day) that we thought you might be interested in seeing how it is done. In an ante-room we have our pump arrangement, built in by our engineer, a very capable man, by the way. Here are a series of these pumps, all connected with different pipes that run up to the ceiling and out through the wall into the wards. They go between the beds in such fashion that each bed has an attachment for suction drainage.

The system is a double inverted cone, with a side attachment, and a very fine stream of water rushing by occasions most satisfactory suction pressure.

Here is the connection apparatus for suction. In this way we keep our patients, I will not say 100 per cent dry, but certainly dryer than we have ever succeeded in doing before, and the system works out most satisfactorily. It is one that can be put in by your engineer. We can certainly recommend it as a suction appliance for ward patients in your hospitals.

Here is the latest high speed rotary pump, gotten up by F. Wappler, son of Reinhold Wappler, who gives promise of being an able successor to his brilliant father. I hesitate to explain the mechanism of it, because it is a little bit over my head. I have a written explanation of it. If any of you wish to see it, I will be glad to show it to you afterwards. This new apparatus

is provided with an attachment for intermittent suction. It is suitable for private patients; is noiseless; and has a self-feeding oiling system. The rheostat can be kept in another room, or in a box. There is no annoyance to the patient, such as attended the first pumps employed by us. It is notable for its automatic features and the need of a minimum of personal attention, and for its cooling system, so that the motor does not get hot, and may run for weeks, if necessary.

One of my associates, Dr. Joseph Hyams, has devised the rather ingenious appliance. It is as yet in the tentative stage and so I cannot say if it will work out in practice as well as it promises. It may, however, give you some ideas. It is intended for injection through a cystoscope or endoscope of novocain, or other anesthetic. It might be useful for Dr. Caulk, for example, in sphincterectomy. In addition it is adjustable for diathermic bulbs or electrodes for glands of Littré.

I do not know how many of you are employing these graduated bulbs, but if you are not I do know that in the infiltrating or recurrent growths, you will get infinitely more effect in deep endothermy than with any other. Being circular, the current is uniformly applied.

Here is a device for the Foreoblique Pan Endoscope with which instrument I think most of you are familiar. I find some men say they can not get along without it. Others say they can do little with the instrument. The individual element, of course, enters here, but the more you apply yourself to it, the greater the dividends. We are using it more and more.

We use a two-cell battery with our cystoscopes and endoscopes because the two-cell battery gives brilliant illumination and very seldom burns out the lamp.

Here there is an additional attachment for this instrument. It is provided with a tube for suction which is carried on with the high speed rotary pump which is very satisfactory. The urethral field in most instances is kept thoroughly dry. There is therefore no necessity for cotton applicators.

The lens system is adjustable to the individual as it is constructed on the principle of the opera glass.

The advantage of this opera glass attachment is that one can visualize way off in one corner of the field, very well indeed, thereby affording much greater operating space than heretofore. (Dr. McCarthy then gave a demonstration of this instrument).

Here is an appliance we have been playing with for a couple of years. I demonstrated this to Dr. Braasch and some of the members present but after two years work we are only beginning to learn how to manipulate it. This is a carrier for bougies or catheters to instrument the ejaculatory ducts. We found that most ejaculatory duct orifices were placed anterolaterally. The adjustable carrier may be slid along the endoscopic light carrier, rotated from side to side in such manner as to bring the orifice through which the bougie must emerge in apposition to the ejaculatory duct.

We have been using this latest model a year or more, and have come to the conclusion, after constant application that mechanically it is correct and that it is largely a matter of experience before we can expect clinical results. We employ a large 3 or a small 4, and in that connection, I might state that the manufacturers who construct these catheters will have to revise their methods and bring to us a more finished workmanship in these small catheters and bougies. This I feel is all we need to perfect this instrumental operative procedure.

(Dr. McCarthy then demonstrated other instruments.)